

A PROPOSED METHODOLOGY FOR ANALYZING
THE NAVAL PETROLEUM RESERVE NUMBER ONE,
ELK HILLS, CALIFORNIA,
PIPELINE CONSTRUCTION DECISION

Bernard Louis Rabold, Jr.

NAVAL POSTGRADUATE SCHOOL

Monterey, California



THESIS

A PROPOSED METHODOLOGY FOR ANALYZING
THE NAVAL PETROLEUM RESERVE NUMBER ONE,
ELK HILLS, CALIFORNIA,
PIPELINE CONSTRUCTION DECISION

by

Bernard Louis Rabold, Jr.

June 1977

Thesis Advisor:

J. D. Buttinger

Approved for public release; distribution unlimited.

T179872

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A Proposed Methodology for Analyzing the Naval Petroleum Reserve Number One, Elk Hills, California, Pipeline Construction Decision		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis; June 1977
7. AUTHOR(s) Bernard Louis Rabold, Jr.		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		12. REPORT DATE June 1977
		13. NUMBER OF PAGES 74
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) pipeline routes Naval petroleum reserve Elk Hills		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Public Law 94-258 requires that a transportation system capable of moving 350,000 barrels of crude oil per day from Naval Petroleum Reserve Number One, Elk Hills, California, to market be provided by the Navy. Analysis of this law results in the identification of a problem statement to determine the transportation system which provides maximum net revenue considering the differential costs and revenues of the possible alternative pipeline routes.		

20. (continued)

A methodology is proposed under which alternatives can be considered in a common format and aggregated so as to make a rational choice. Costs are based on engineering studies previously conducted. Revenue from the sale of the crude oil is based on the production volume multiplied by the well price of the crude. This well price is determined by establishing refinery market locations, flows, and prices and subtracting transportation costs back to the well. Revenue from operation of the Navy owned portion of the transportation system is based on the projected pipeline tariff and flow rate.

Application of the methodology to alternative systems under consideration by the Navy is done in order to illustrate the methodology and to provide information relating to alternative choice.

Approved for public release; distribution unlimited.

A Proposed Methodology for Analyzing the Naval Petroleum Reserve
Number One, Elk Hills, California, Pipeline Construction Decision

by

Bernard Louis Rabold, Jr.
Lieutenant, Civil Engineer Corps, United States Navy
B.M.E., Georgia Institute of Technology, 1970

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the
NAVAL POSTGRADUATE SCHOOL
June 1977

ABSTRACT

Public Law 94-258 requires that a transportation system capable of moving 350,000 barrels of crude oil per day from Naval Petroleum Reserve Number One, Elk Hills, California, to market be provided by the Navy. Analysis of this law results in the identification of a problem statement to determine the transportation system which provides maximum net revenue considering the differential costs and revenues of the possible alternative pipeline routes.

A methodology is proposed under which alternatives can be considered in a common format and aggregated so as to make a rational choice. Costs are based on engineering studies previously conducted. Revenue from the sale of the crude oil is based on the production volume multiplied by the well price of the crude. This well price is determined by establishing refinery market locations, flows, and prices and subtracting transportation costs back to the well. Revenue from operation of the Navy owned portion of the transportation system is based on the projected pipeline tariff and flow rate.

Application of the methodology to alternative systems under consideration by the Navy is done in order to illustrate the methodology and to provide information relating to alternative choice.

TABLE OF CONTENTS

I.	BACKGROUND-----	7
	A. NAVAL PETROLEUM RESERVES -----	7
	B. NAVAL PETROLEUM RESERVE NUMBER ONE -----	8
	C. LEGISLATIVE ACTION -----	10
II.	NATURE OF THE PROBLEM -----	12
	A. PUBLIC LAW 94-258 -----	12
	B. TASK ASSIGNMENTS -----	15
	C. PROBLEM ASSESSMENT -----	18
	D. PROBLEM STATEMENT -----	21
	E. ALTERNATIVE IDENTIFICATION-----	22
	1. Alternative A -----	22
	2. Alternative B -----	23
	3. Alternative C -----	23
	4. Flow Rates -----	23
III.	METHODOLOGY -----	24
	A. INVESTMENT COSTS -----	24
	B. OPERATIONS AND MAINTENANCE COSTS -----	25
	C. REVENUE FROM THE SALE OF CRUDE OIL -----	26
	1. Refinery Market and Price Determination -----	27
	2. Transportation Cost Determination -----	29

a. Navy Pipeline Tariffs -----	29
b. Existing Pipeline and Tanker Tariffs -----	32
3. Total Revenue from Sale of Crude -----	32
D. REVENUE FROM OPERATION OF THE NAVY PIPELINE-----	33
E. COMMON FACTORS -----	33
F. SUMMARY -----	34
IV. APPLICATION OF METHODOLOGY -----	35
A. INVESTMENT AND OPERATIONS/ MAINTENANCE COSTS -----	35
B. REVENUE FROM THE SALE OF CRUDE OIL -----	36
1. Refinery Market Location -----	36
2. Price of Crude at Refinery Markets-----	42
3. Transportation Costs and Total Revenue -----	45
a. Alternative A -----	45
b. Alternative B -----	48
c. Alternative C -----	48
C. REVENUE FROM OPERATION OF THE NAVY PIPELINE -----	51
D. NET REVENUE CALCULATIONS -----	52
V. SUMMARY, COMMENTS AND RECOMMENDATIONS -----	53
LIST OF REFERENCES -----	71
INITIAL DISTRIBUTION LIST -----	73

I. BACKGROUND

A. NAVAL PETROLEUM RESERVES

There are four Naval Petroleum Reserves: Number One, Elk Hills and Number Two, Buena Vista Hills, both located in Kern County, California; Number Three, Teapot Dome in Wyoming; and Number Four in Northern Alaska. All of these reserves were established through presidential order from 1912 to 1923. The compelling reason behind their establishment was the need to provide a secure supply of oil to the U. S. Navy, which at that time was converting its fleet from coal to oil fuels. As a result, the responsibility for administration and operation of the petroleum reserves was assigned to the Department of the Navy.

Naval Petroleum Reserve Number One (NPR-1), the subject of this thesis, encompasses 46,095 acres of land and contains a proven oil reserve of over one billion barrels [Ref. 6, p. 68]. Proven reserves represent quantities of oil (or gas) which geological and engineering data demonstrate, with reasonable certainty, to be recoverable from known reservoirs under existing economic and operating conditions. There are over 1,000 wells on the site with further drilling currently in progress. Approximately 20% of the field is owned by the Standard Oil Company of California (SOCAL),

and the remaining 80% of the field is owned by the United States government. For the most part, NPR-1 has been kept in a shut-in, minimum production status.

NPR-2, located adjacent to NPR-1, covers 30,191 acres of land with a proven reserve of approximately 20 million barrels. This reserve is fully developed and is in a production status. The United States government owns 1/3 of the reserve with the remaining 2/3 being owned by private concerns.

NPR-3, located near Teapot Dome, Wyoming, includes 9,481 acres with a proven reserve of over 40 million barrels. This reserve is wholly owned by the United States government and is being produced.

The largest land area under the Naval Petroleum Reserve program is contained in NPR-4 located on the northern coast of Alaska. NPR-4 contains 37,000 square miles with an estimated reserve of 10 to 30 billion barrels. This reserve is for the most part unexplored and undeveloped.

B. NAVAL PETROLEUM RESERVE NUMBER ONE, ELK HILLS

The focus of this study is the current status of NPR-1, Elk Hills. As of June, 1977, when NPR-4 will be turned over to the Department of Interior, NPR-1 will be the largest Naval petroleum reserve. Significant investments have been made and are projected to be made in the future into this petroleum reserve.

NPR-1, Elk Hills, is located in Kern County, California, about 35 miles west of Bakersfield, California. Oil production from NPR-1 began in 1919 from a well drilled by SOCAL. In 1942 NPR-1 was enlarged to its present size of 46,095 acres by executive order of President Franklin D. Roosevelt. Following this enlargement, a unit plan contract was entered with SOCAL in 1944 for the exploration, development, and operation of all unit lands within the reserve.

The unit plan contract provides that the major portion of NPR-1 is to be operated as a single property controlled by the Secretary of the Navy acting through the Director of Naval Petroleum and Oil Shale Reserves, Department of the Navy. The exploration, development, and production functions of the reserve are under the direction of an operating committee which is supported by an engineering committee. Both committees are made up of an equal number of representatives of the Navy and SOCAL [Ref. 13].

As of 3 July 1976, slightly more than 302 million barrels of crude oil had been provided from NPR-1 and over 1,009 million barrels were identified as remaining proven reserves. The revenue from the sale of the oil has amounted to more than \$265 million and over \$220 million has been invested in the reserve for exploration, development, and production functions [Ref. 8].

C. LEGISLATIVE ACTION

Prior to 5 April 1976, NPR-1 was operated under the authority of Chapter 641, Title 10 United States Code, which granted the Secretary of the Navy exclusive jurisdiction over the petroleum reserve with direction to explore, prospect, conserve, develop, use, and operate the reserve. Production of the reserve under this authority was limited to that which was necessary for protection, conservation, testing, and maintenance of the reserve. Any other production had to be based on a requirement for national defense with authorization required from Congress and the President. Under the terms of this directive, NPR-1 was considered to be a "shut-in" condition, with production taking place at approximately 2500 barrels per day as of July, 1976 [Ref. 8].

The now famous oil embargo and fuel crisis of 1973 brought about increased congressional and public interest in the naval petroleum reserves. Although NPR-1 is one of the largest oil fields in the United States, problems were encountered in attempting to provide this oil to the market place. Transportation constraints resulting from a limited pipeline capacity from NPR-1 would restrict the delivery of crude oil from NPR-1 to 30,000 barrels per day. Even after a 90 day period to allow for expansion of the existing facilities, the maximum delivery rate would be 130,000 barrels. With thousands of people waiting in line to purchase gasoline and military operations

being curtailed due to fuel shortages, Congress found itself under increasing pressure to take action to alleviate the fuel shortage and open up the naval petroleum reserves to full production.

The action relative to the naval petroleum reserves taken by Congress and approved by the President is contained in Public Law 94-258 of April 5, 1976 [Ref. 11]. Title I of this law transferred administration of NPR-4 (Alaska) from the Department of the Navy to the Department of the Interior. Title II of this law authorized production from the remaining naval petroleum reserves and required the Navy to provide a transportation system for the oil produced from NPR-1.

II. NATURE OF THE PROBLEM

A. PUBLIC LAW 94-258

In determining the specific problem facing the Navy with regard to Public Law 94-258, the viewpoints of the participants in the action must be considered. A logical starting point for this analysis is the U. S. Congress, the initiator of the law.

Legislative action concerning the naval petroleum reserves was initiated within the House of Representatives. Briefly, the House proposed that a system of national petroleum reserves be established for both the reserved and unreserved public lands of the United States. The naval petroleum reserves would be included in this proposal. The development and production of petroleum within this newly established national petroleum reserve would then be undertaken by the Department of Interior.

The Senate did not agree with the House proposal and offered an amendment to the proposed legislation. The Senate amendment authorized production from NPR-1, 2, and 3 under Navy jurisdiction for 5 years. The revenues from this production would then help offset the expense to complete the development of the naval petroleum reserves and to establish the strategic energy reserve system designed to store a quantity of petroleum for emergency use [Ref. 9].

The compromise bill which was the product of a congressional joint committee is Public Law 94-258, which is presented in Appendix

A. A summary of the provisions of this law which affect NPR-1 follows:

(1) Production of petroleum from NPR-1 will commence immediately at the maximum efficient rate* and will continue for a period of 6 years. Extension of this production period is allowed if congressional and presidential approval are granted.

(2) Storage and shipping facilities will be constructed, acquired, or contracted for, which will be capable of transporting 350,000 barrels of crude oil per day to a shipping or marketing point. Such facilities will be operational not later than 5 April, 1979.

(3) The petroleum produced will be used, stored, or sold by the Secretary of the Navy. Use of the petroleum refers to energy requirements in connection with operation and production activities, such as engines driving pumping stations. Storage applies only to that which is necessary to transport or sell the petroleum. Only by presidential directive can this petroleum be used as part of the strategic energy reserve system. Sale of the petroleum is to be by competitive bidding

*Maximum efficient rate (MER) refers to the maximum rate of production for a given oil field that cannot be exceeded without a decrease in ultimate oil recovery. MER is determined through a highly technical analysis of information about the oil field. Additionally the MER must be periodically re-evaluated due to changes in the field as result of production. While economic or legal factors do not enter into the determination of MER, they may dictate a lower rate of production. Production at a rate less than MER will not lower the ultimate recovery from the field [Ref. 1].

for a contract term not to exceed one year. Additionally, any single purchaser is limited to not more than 20% of the total production.

(4) A special account entitled Naval Petroleum Reserves Special Account is established. All revenues from and appropriations to naval petroleum reserve activities will be credited to this account. These funds will then be made available for expenditure on (a) further development of the reserves, (b) construction and operation of facilities incident to the production and delivery of the petroleum, (c) the construction and operation of facilities associated with the strategic petroleum reserve, including the procurement of petroleum for the reserves, and (e) the exploration of the National Petroleum Reserve in Alaska (previously known as NPR - 4).

The congressional conference committee in a joint statement concerning this bill states that the House and Senate bills, though seeking to achieve somewhat different objectives through different agencies were both seeking to resolve the long standing issue of great national importance, "how the petroleum resources owned by the United States government in the public lands reserved for the four naval petroleum reserves can best serve the public interest" [Ref. 7]. The final legislative product indicates that the public interest will be best served by developing and producing the naval petroleum reserves and establishing a strategic petroleum reserve system, both of which will be funded from revenue from the sale of the crude oil from the three

remaining naval petroleum reserves. Through this law the legislature has tasked the Department of Defense, the Department of Interior, and the Federal Energy Administration to carry out the provisions of the law.

B. TASK REQUIREMENTS

The Department of Defense, acting through the Department of the Navy, is tasked to produce the naval petroleum reserves at the maximum efficient rate (MER). The MER, described earlier, is determined through an established set of engineering calculations with little leeway in the determination of the final production amount. Public Law 94-258 specifies the capacity which must be transported from Elk Hills (which appears to be determined quite independently from the MER), and the law also gives the required completion date of 5 April, 1979, for the transportation system. The analysis, design, environmental permit procedures, and construction time requirements point to the fact that completion within the three years allotted will be difficult. Thus, the Department of Defense and the Navy view the time resource as a real constraint in this project.

The common use of the Naval Petroleum Reserves Special Account by the Department of Defense, the Department of the Interior, and the Federal Energy Administration poses a potential problem area. Each agency is tasked to carry out certain functions which are all to be

funded from the revenues into this special account. The Navy is to develop and produce the reserves as well as construct and operate a transportation system from NPR-1 to market. The Department of Interior is to explore and develop the National Petroleum Reserve in Alaska. The Federal Energy Administration is to establish and operate the national strategic petroleum reserves. Competition among these agencies can be expected for the funds within the special account. It is conceivable that during the early stages of the development of this program the high cost of investment and limited output at NPR-1 (due to lack of an adequate transportation system) might result in a demand for funds which would exceed the supply, thus necessitating additional appropriations from Congress to carry out some of the activities. A future consideration might involve a Navy desire to halt production and return NPR-1 to a shut-in status, after required production and transportation facilities have been installed and paid for. At the same time either the Department of Interior or Federal Energy Administration may desire further production in order to continue the funding source for their particular programs.

With increasing budgetary pressure on all federal agencies, each participant in the special account will have a real incentive to fund his particular tasks from the revenues from the sale of the crude oil. This factor could result in conflicting pressures concerning the amount or length of time or production. These specific possibilities

make the general point that different viewpoints among the participants can emerge at any time to produce conflicting policy on production of the reserve.

Other participants in this law are the State of California, private oil companies (including SOCAL), and the user public. California is extremely interested in the production of crude oil from several aspects. This state is a trend-setter with regard to environmental considerations, and as such is concerned about the impact the production and transportation of this crude oil will have within its boundaries. The economic impact is of concern also, especially considering the potential over supply of crude oil along the West Coast resulting from the Prudohoe Bay, Alaska production.

Private oil companies are interested in the choice of transportation systems and the production of crude from NPR-1 as it applies to their specific interests. Such factors as use of the transportation system, or supply of crude for refineries, or effect of crude production on existing crude supplies will be of vital interest to the private oil companies operating in the area. SOCAL will have a definite interest in the implementation of Public Law 94-258 since it owns some 20% of the oil field under the unit plan contract.

User public interest in Public Law 94-258 is varied and perhaps apathetic, but the price of petroleum at the gas station pump is a point of common concern to consumers. Avoiding the "gas lines" of 1973 is also another common consumer concern.

C. PROBLEM ASSESSMENT

Establishing a specific program to meet an agency's tasking requirements of Public Law 94-258 requires a review of the viewpoints of the other federal agencies involved in the situation. Although the Navy is tasked as the action party in bringing NPR-1 under production and providing the transportation system, the Navy must take care to consider the other participants in specifying the methods of accomplishment.

Of first concern to the Navy should be compliance with what will be called "hardware" requirements of the law. The mandates of the law will establish the framework within which other choices can be made. The "hardware" requirements of the law can be summarized as follows:

- (1) Produce NPR-1 at the maximum efficient rate from 5 April, 1976 to 5 April, 1981.
- (2) Construct, acquire, or lease shipping facilities and pipelines for the purpose of transporting crude from NPR-1 to a shipping or marketing point.
- (3) The transportation system will have a 350,000 barrel per day capacity and will be operational not later than 5 April, 1979.

Next, one should examine the objectives and viewpoints of the other participants in the program. One of the most important areas to address is that of costs and revenues, and more specifically, who pays and who receives. Under the provisions of the law, all revenues

from the sale of the crude will go into the special account which is
used jointly by the 3 federal agencies. Each agency will be interested
in obtaining a proportionate share of this revenue in support of its
own program. Maximization of net revenue would seem to be a com-
mon goal.

A potential conflict may arise between the Department of Defense
and the Federal Energy Administration. In establishing the strategic
oil reserves, the possibility exists that the Federal Energy Administra-
tion might determine that the best method of assuring petroleum supply
is to leave it in the ground at the naval petroleum reserves. This
desire would be in complete conflict with the directive to the Navy to
produce the fields at a maximum efficient rate. An additional conflict
might arise between the Department of Defense and the Federal Energy
Administration over the strategic issues concerning oil storage. The
change of administration over these supplies from the Department of
Defense to the Federal Energy Administration could present conflicting
viewpoints. Both of these issues are outside the scope of this thesis,
and are presented as possible questions to answer.

The impact of the state of California on the alternatives facing
the Navy is mainly in the area of environment and ecology. Opposition
can be expected on any aspect of the proposed transportation system
which presents a high risk to the environment, especially the air and/
or water quality. The awareness of California public interest groups

is very high as the result of environmental problems such as the Los Angeles smog and the Santa Barbara off shore well blow outs.

Any viewpoint taken from the private oil companies would require an individual strategic analysis of that company, which is beyond the scope of this thesis. If such a study were undertaken information on crude oil supplies, marketing areas, capital investment posture, international relations, and tax considerations would be important areas to consider,

The "public" is a difficult entity about which to generalize. Even though NPR-1 is currently the second largest producing field in the western half of the nation, a comparison of the projected flow of 350,000 barrels per day from this field to the national demand of 18.3 million barrels per day indicates the "insignificance" of this one field [Ref. 5]. Perhaps the importance of this oil can be better discussed with regard to geographic areas of demand. Areas of our country, including the Midwest, are currently experiencing oil shortages of varying degrees. Other areas, including New England, must rely heavily on foreign imported crude oil to meet demands. With respect to a specific area of the country, 350,000 barrels per day would in fact make a large impact on the supply and demand status of oil. This idea brings the public market requirements into the decision. In other words, where can all of this crude oil produced under the maximum efficient rate concept be sold?

D.. PROBLEM STATEMENT

In sorting through the various viewpoints and special interest areas of the participants, one finds a myriad of objectives and problem definitions. A thesis including the entire scope of these viewpoints could be presented on discussing and specifying the exact problem facing the Navy in complying with Public Law 94-258. In order to reduce the problem into a form which is addressable within the scope of this thesis the problem will be expressed as follows:

Maximize the net revenue into the Naval Petroleum

Reserves Special Account taking into consideration

(1) revenue from the sale of the crude oil, (2) revenue from the operation of the transportation system, and (3) investment and operation cost of the transportation system.

Choice of the above problem statement will provide maximum funds for use among the three participating federal agencies. It will also provide for proper resource allocation concerning the investment aspect of the decision. Although the environment issue is not specifically addressed in the problem statement, in providing the capital investment costs, compliance with all existing environmental constraints will be included. This will ensure that each investment alternative under consideration will be acceptable under existing environmental requirements.

E. ALTERNATIVE IDENTIFICATION

The process of identifying alternate methods of transporting crude oil from NPR-1, Elk Hills, which comply with the provisions of Public Law 94-258 is accomplished by taking the alternative transportation systems currently under consideration by the Office of Naval Petroleum and Oil Shale Reserves. No attempt has been made to generate new alternatives or modify the existing alternatives.

The alternative transportation methods considered in this thesis are as follows:

1. Alternative A

Construct a pipeline between Elk Hills and Redlands, California. At Redlands, a connection will be made with a proposed Standard Oil Company of Ohio (SOHIO) pipeline which will run between Long Beach, California, and Midland, Texas. Existing pipelines serving the Midland area will then allow shipment of the crude to be made either north into the Midwest area or east into the Gulf Coast area.

The proposed SOHIO pipeline is a large capacity pipeline with the primary objective of transporting Alaskan crude oil to the mid-continent region. The project is currently in the application and permit stage and its future is uncertain due to strong opposition in California. For purposes of this thesis, it will be assumed that the SOHIO pipeline will be approved and constructed in a timeframe which will allow compliance with the operational deadline for the Navy pipeline as established in Public Law 94-258.

2. Alternative B

Construct a pipeline from Elk Hills to Port Hueneme, California.

At Port Hueneme a marine terminal will be constructed and shipment of the crude to refinery locations will be via tanker.

3. Alternative C

Construct a pipeline from Elk Hills to Coalinga, California, where connection will be made to several existing pipelines which terminate at the refineries in the San Francisco Bay area. The option exists under this alternative to split part of the flow in the Navy pipeline through existing pipelines to the Avila Beach and/or Estero Bay area (both located near San Luis Obispo, California) to existing marine terminals which will allow shipment to refinery locations via tanker.

4. Flow Rate

The flow rate considered for each of the above alternatives allows for an initial capacity of 200,000 barrels per day with the ability to expand the flow to 250,000 barrels per day. The difference between this capacity and the capacity of 350,000 barrels per day stipulated in Public Law 94-258 will be handled by contracting for the use of the existing excess pipeline capacity in the Elk Hills area. The Office of Naval Petroleum and Oil Shale Reserves estimates that the existing pipelines leading from Elk Hills to various shipping and marketing points will be able to transport 100,000 to 150,000 barrels per day. Determination of the exact excess capacity is a difficult problem, but presently over 122,000 barrels per day are being shipped from NPR-1 through the existing pipeline capacity.

III. METHODOLOGY

The methodology of choosing the best alternative from the three previously identified alternatives must be related to the problem statement of maximizing net revenues. In broad terms, the differential costs and revenues associated with each alternative must be identified, aggregated on a common basis, and compared. The term differential is used to describe a cost or revenue which varies depending on the choice of alternatives. This concept allows one to disregard the effect of the common costs and revenues to the three alternatives.

A. INVESTMENT COSTS

The first cost to be identified with each alternative is that of the investment. The investment cost represents the front end cost required to install the system and begin operations. This cost includes only the investment costs incurred by the Navy in installing the facilities under their control. Any investments made by outside agencies or companies which are not reimbursed by the Navy are not considered relevant as investment costs.

In order to aggregate the investment costs with the other cost and revenue data which is on an annual basis, the investment costs must be annualized using present value techniques. The discount rate used for this annualization is 10%, the standard rate prescribed by the Department of Defense [Ref. 3].

The choice of an economic life is not quite as straightforward. The operation of the pipeline is only assured for three years (based on Public Law 94-258). Any production of crude oil from NPR-1 after April 1981, will require Congressional and Presidential approval. The expected physical life of pipelines is quite a bit longer than this three year period - perhaps in the range of 25 to 50 years. The Interstate Commerce Commission (ICC), the federal regulatory body controlling interstate oil pipeline operations, specifies an economic life of 20 years for pipelines for purposes of determining acceptable tariffs.

For purposes of this thesis, an economic life of 20 years for the pipeline will be assumed. The 20 year period is chosen because it reflects the economic life used in actual practice by the ICC. Although the choice of the economic life is an important aspect of the problem, the value chosen will not affect the relative ranking of the alternatives on the basis of net revenue, since the same economic life will be used on each alternative.

B. OPERATIONS AND MAINTENANCE COSTS

The next cost considered is that of operations and maintenance. These costs are estimated for each alternative on an annual basis. Annual costs which are common to all alternatives include exploration, development, and production costs associated with the crude oil in

NPR-1. These costs involve the discovery of the crude, getting the crude out of the ground, and making the crude ready for sale. They do not depend on the choice of transportation alternatives; therefore these costs are not considered relevant to this analysis.

C. REVENUE FROM THE SALE OF CRUDE OIL

The first revenue to be identified is that obtained from the sale of the crude oil. The total revenue from this sale is simply the quantity of crude sold multiplied by the price paid at the well for the crude. A distinction between the price of the crude oil at the well and at other points in the transportation system must be made. Sale of the crude oil by the Navy is based on transfer of ownership at a metering station located at the boundary line at NPR-1. The price bid for the crude oil at this location will be referred to as the price at the well. After transfer of ownership of the crude, it becomes the responsibility of the owner of the crude to make transportation arrangements. Transportation options for the new owner include use of existing excess capacity in present private pipelines or use of the proposed Navy pipeline. The Navy pipeline must be operated on the basis of a common carrier, and a tariff will be charged for use of the facilities.

Calculation of the unit bid price at the well is based on a model developed by the Federal Energy Administration (FEA) which was used

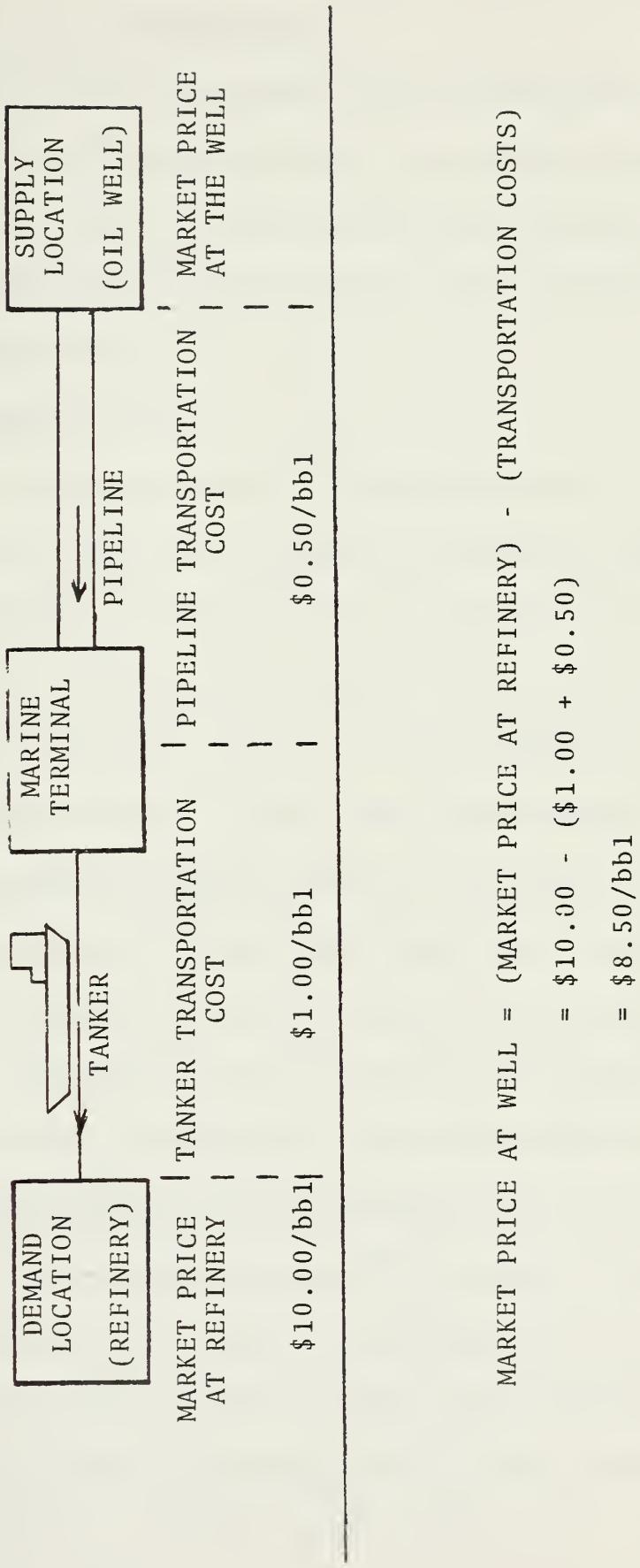
to determine the price at the well for the crude oil produced at the Prudhoe Bay Field, Alaska [Ref. 6]. In the FEA model the location of refineries desiring to purchase Alaskan crude was determined and the market price for crude oil was found for that particular location. From this market price at the refinery, the transportation charges required to move the crude from the oil field to the refinery were subtracted. The resulting price reflects the market price of the crude oil at the well. This model is illustrated in Fig. 1.

1. Refinery Market and Price Determination

To apply the FEA crude oil pricing model to the alternative choice at NPR-1, one must first identify the refinery areas served by each alternative. Then the transportation costs to move the crude oil from the oil field to the refineries must be calculated and subtracted from the market price of the crude oil at the refinery, giving the price of the crude at the well.

A detailed determination of the refinery market areas under each alternative is a subject which is complicated by, for example, the vertical integration of oil companies and the international aspects of the petroleum industry. For purposes of this thesis, estimates of market locations and flows from NPR-1 to these markets will be made based on the location of the Navy pipeline terminals, geographic limitations, and historical data. Although these choices are rather arbitrary, it is hoped that some indication can be obtained as to the effect of the market forces on the revenue from the sale of the crude.

FIGURE 1 FEA CRUDE OIL PRICING MODEL



2. Transportation Cost Determination

Determination of the transportation costs for moving the crude oil from NPR-1 to the various refinery markets also presents a difficult problem. The first leg of the transportation system will be via the Navy pipeline. The method of estimating the tariff for the Navy pipeline will be discussed first.

a. Navy Pipeline Tariffs

The first question to answer in determining the tariff for the Navy pipeline is, "What is the objective in operating the Navy pipeline, to break even or to make a profit?" Consider the operation of the Navy pipeline on a break even basis. Since the Navy does not pay taxes, dividends, and interest, the costs of a Navy pipeline on a break even basis will probably be less than those costs incurred by a private corporation operating a similar pipeline. If the tariff for the Navy pipeline is assessed based on this reduced cost basis, the Navy tariff will probably be less than the tariff for the private corporation. Next, consider that of the 350,000 barrels per day to be transported from NPR-1, only 200,000 barrels per day will be transported through the Navy pipeline. The remaining 150,000 barrels per day will have to be transported via existing pipelines operated by private corporations. These corporations must base their tariffs on costs which are not comparable to those of a break even Navy pipeline. Thus, the operation of the Navy pipeline on a break even basis would place the operators of

the existing pipelines in an undesirable competitive position against the Navy. In the event that the flow of crude from NPR-1 was reduced for any reason (including changes in production due to maximum efficient rate considerations), the existing pipelines could conceivably experience a loss of business as the result of their higher tariffs. The Navy would then find itself in the undesirable position of presenting unfair competition to private corporations by undercutting the price structure.

Next, consider the operation of a Navy pipeline as a private corporation which would operate under the regulations of the ICC. The approval of tariffs by the ICC is based on a cost of service concept. Common cost factors for pipeline operations have been identified and guidelines are established for accounting procedures. The factors included in the cost of service approach include the rate of return on the rate base, the debt to equity ratio, debt servicing charges, operating and depreciation costs, and taxes. Treatment of factors such as the maximum rate of return, depreciation methods, and economic lives are specified in order to assure a common basis for tariff determination. The tariff is calculated by annualizing the cost of service factors and dividing this figure by the flow rate for the pipeline, thus arriving at a tariff stated in cost per unit of flow. Application of the cost of service computation to a Navy pipeline is simply not possible because the figures for taxes, profits, and interest charges are not a part of the Navy accounting system.

An approximation of the cost of service approach was developed by Debanne [Ref. 2]. He proposed that pipeline costs could be condensed fairly accurately into a percentage per year of the total pipeline investment cost. His approximation in 1971 for this percentage was 17%. Using this method, computation of the tariff is accomplished by multiplying this percent of investment cost (17%) by the investment cost, and then dividing this product by the annual flow through the pipeline. The result, stated in cost per unit of flow, represents the approximate tariff which would have been determined from a detailed cost of service analysis of the pipeline operation.

This same approximation of the cost of service approach was used in a study of petroleum transportation costs undertaken by Project Independence in 1974 [Ref. 4]. The percentage of total investment used in this study was 20%. No explanation was offered as to the reason for modifying Debanne's figure of 17%. One possible explanation of this modification is that more recent data was available to the Project Independence team in determining this number, but no confirmation of this explanation has been found.

For purposes of this thesis, the factor of 20% will be used to estimate the tariff for the Navy pipeline. Under this assumption, the Navy pipeline will be placed in a "competitive" position with private corporations.

b. Existing Pipeline and Tanker Tariffs

In computing the transportation costs from the point of termination of the Navy pipeline to the refinery market, estimates of transportation costs are made based on existing or proposed pipeline tariffs and tanker rates. Many variables are present in the pipeline and tanker transportation businesses which make this task difficult. Many pipelines are owned and operated by oil companies for their exclusive use and are not common carriers. Thus, these pipelines are not regulated by either federal or state agencies and do not publish tariffs for their services. In dealing with tanker transportation, the size of the tankers, the capacity of the port areas (in terms of number and size of tankers), and length of time for the transportation agreements (single voyage or lifetime charters) all have an effect on the tariff charged.

3. Total Revenue from Sale of Crude Oil

By combining the estimate of the Navy pipeline tariff with the estimates of the existing or proposed crude oil transportation systems, a total transportation cost from NPR-1 to each refinery market can be calculated. Then this transportation cost can be subtracted from the market price of the crude oil in the refinery area to obtain the price of the crude at the well. Thus, knowing the price of the crude at the well and the volume produced, the total revenue received is simply the product of the two factors.

D. REVENUE FROM OPERATION OF THE NAVY PIPELINE

The next item of revenue to be considered is that resulting from the operation of the pipeline. As previously noted, the basis for determining the Navy pipeline tariff is a cost of service approach under an assumption of a competitive position to public corporations vice a break even approach. Under these circumstances the revenue from the pipeline tariff will exceed the costs to operate and maintain the pipeline, resulting in net revenue to the Navy. The revenue is simply calculated by multiplying the proposed tariff by the flow.

E. COMMON FACTORS

Factors common to revenue considerations in this analysis include the quantity of crude transported through the existing pipelines. Public Law 94-258 mandates that the Navy provide a transportation system capable of transporting 350,000 barrels of crude per day to shipping or marketing points, yet the proposed alternative Navy pipelines are designed for an initial capacity of 200,000 barrels per day with expansion capability to 250,000 barrels per day. The difference in quantities is planned to be handled through the use of excess capacity in existing pipelines serving the Elk Hills area. The choice of an alternative pipeline route is assumed to have no effect on the revenue from the sale of crude flowing through the existing system. This assumption is made because the market for crude at the end of the existing pipeline

system is predetermined by virtue of the use of that system. Therefore, the market forces are already in effect providing a market price for that crude at the well. This allows one to treat the revenue from the crude flowing through the existing pipelines as a common item, thus allowing elimination from this analysis.

F. SUMMARY

In summary, costs and revenues are identified and annualized using a 10% discount rate and a 20 year economic life estimate. Costs and revenues which do not vary according to alternative choice of pipelines are not considered. Differential costs identified include investment and operations maintenance costs. Differential revenues include receipts from the sale of the crude oil flowing through the Navy pipeline and receipts from the tariff assessed for the use of the Navy pipeline. The aggregated amount of these annual costs and revenues will then provide a basis for selecting the alternative which will result in the maximum net revenue for the system.

IV. APPLICATION OF METHODOLOGY

The next step in the analysis of the alternatives at NPR-1, Elk Hills, is to establish facts and figures and apply such to the methodology discussed in Chapter III. In establishing values for the factors which comprise the methodology model, numerous assumptions and extractions from data are required. It is realized that a wide range of approaches to facts and figures exists in this application stage. The approach taken in this thesis as to costs and revenues can certainly be questioned and readers with knowledge of the situation are encouraged to do so. Note, however, that the methodology provides a framework for collecting and testing facts and assumptions. A detailed discussion of the author's assumptions and sources of data is provided in order to establish a basis for possible improvements to the application process.

A. INVESTMENT AND OPERATIONS/MAINTENANCE COSTS

Data on costs, both investment and operations/maintenance, was obtained from a survey of preliminary engineering studies on the alternatives [Ref. 9, 12]. Investment costs are tabulated in Appendix B. Appendix C presents the annual operations/maintenance costs for each alternative.

A summary of the relative costs to this analysis is presented in Table 1.

Table 1. COST SUMMARY

COST (annual)	ALTERNATIVE		
	A	B	C
INVESTMENT*	\$11,985,000	\$ 9,517,500	\$ 7,050,000
OPERATIONS/MAINT	\$ <u>2,485,000</u>	\$ <u>3,275,000</u>	<u>1,772,000</u>
TOTAL	\$14,470,000	\$12,792,500	\$ 9,822,000

*Investment cost refers to the equivalent annual cost as calculated in Appendix B.

B. REVENUE FROM THE SALE OF CRUDE OIL

In applying the methodology to the anticipated revenue from the sale of the crude, the first step is to identify the refinery markets and flows for each alternative. Geographic limitations and historical demand form the basis for establishing the refinery market locations and the flow rates to each location.

1. Refinery Market Determination

Consideration of Alternative A shows that the full flow of crude oil from NPR-1 (200,000 barrels per day) must be transported to Midland, Texas. A major factor which must be considered as part of this alternative is the capacity and objective of the SOHIO pipeline, through which NPR-1 crude must travel. The original capacity of

the SOHIO line is set at 600,000 barrels per day with expansion capacity to 1,200,000 barrels per day, and the main objective of the pipeline is to transport crude oil originating in Alaska to the mid-continent region of the United States. This means that the crude oil from NPR-1 will represent a minority amount of the volume of crude passing through the SOHIO pipeline.

The refinery capacity at Midland, estimated at 265,000 barrels per day and under a 90% utilization factor in 1975, is not capable of absorbing the crude from the SOHIO line [Ref. 6, p. 275]. It then becomes obvious that the crude must be transshipped from Midland to other refinery areas. An FEA study in October, 1976, stated that the only pipelines leaving the Midland area which have excess capacity are those going east to the Texas Gulf Coast area. No spare capacity existed in a northerly direction from Midland, but future expansion could possibly provide additional capacity to Minneapolis, Minnesota [Ref. 6, p. 275]. A review of the actual pipeline deliveries of crude oil from Midland to refinery areas in 1972 showed that 74% of the crude went to Houston, Texas, 24% went to St. Louis, Missouri, and 2% went to Kansas City, Missouri [Ref. 4, p. v-14].

A reasonable projection for the distribution of crude oil flowing into Midland is that the bulk of the crude would be directed toward the Texas Gulf Coast due to the availability of excess pipeline capacity. This projection should, however, take into account future expansions

of pipeline capacity from Midland north to Minneapolis. The 1972 data on actual deliveries of crude from Midland shows that the flow distribution of 74% to Houston and the remaining 26% going north to St. Louis and Kansas City provides an approximation of this projection. Therefore, an assumption is made that the crude distribution from Midland will be based on the percentage of actual deliveries in 1977. The following locations and flows are used:

Houston, Texas, 74%, (148,000 barrels per day);

St. Louis, Missouri, 24%, (48,000 barrels per day);

Kansas City, Missouri, 2%, (4,000 barrels per day).

Alternative B sends the full flow of NPR-1 crude (200,000 barrels per day) via tanker from Port Hueneme, California, to a refinery area. In considering the refinery areas on the West Coast of the United States, three major areas are identified, Los Angeles, California; San Francisco, California; and Seattle, Washington. In addition another potential market for NPR-1 crude exists by using the Panama Canal, thus opening up both the Gulf Coast and East Coast refinery areas.

Determination of specific refinery areas and flows serviced by a tanker route through the Panama Canal is a difficult, complicated task. A reasonable assumption on this issue is to recognize that the high transportation cost caused by the long distance and use of relatively small tankers due to size restrictions on the Panama Canal will probably

limit the use of this route. Another point of consideration is the prediction made by the FEA in October, 1976, that the major participants in the North Slope crude production will obtain a profit advantage by marketing as much crude as possible on the West Coast, which results in minimization of North Slope crude marketing into the Gulf Coast, Midwest, and East Coast areas [Ref. 6, p. 175]. At this point, a simplifying and arbitrary assumption is made in order to complete this part of the model. In order to account for the high transportation cost to the potential markets, 25% (or 50,000 barrels per day) of the crude will be assumed to travel via tanker from Port Hueneme to Houston, Texas. The remaining 75% of the crude will be divided among the major West Coast refinery areas. The basis for distribution of the crude on the West Coast is the percentage of 1975 refinery capacity in each area. The percentages and flows are as follows:

Los Angeles, California, 51% (77,000 barrels per day);

San Francisco, California, 30% (45,000 barrels per day);

Seattle, Washington, 19% (28,000 barrels per day)
[Ref. 6, p. 53].

Note that although these assumptions can, of course, be challenged as data becomes available, that a change in the per cent of flow distribution does not change the analysis methodology.

Alternative C involves a rather complex distribution system for the NPR-1 crude. The Navy pipeline to Coalinga, California, is

proposed to be constructed such that tie-ins can be made to existing pipelines serving Avila Beach, California, and Estero Bay, California. A flow of 5,000 barrels per day is projected to Avila Beach and 40,000 barrels per day to Estero Bay. Since both of these locations are marine terminals requiring tanker loading, and since both locations are geographically close together, a simplifying assumption is made which considers a single flow of 45,000 barrels per day to Estero Bay. The remaining flow (155,000 barrels per day) will then go into existing pipelines for delivery to the San Francisco Bay area refineries.

Under this alternative, the only choices to be made for refinery locations are for the crude delivered to Estero Bay. The problem of identifying locations and flows for a tanker route is similar to that discussed under the previous section on Alternative B. Again a simplifying assumption is made to transport 25% of the crude (11,000 barrels per day) through the Panama Canal to Houston. The remaining flow will be split between the remaining two major West Coast refinery areas on the basis of 1975 refinery capacity as follows:

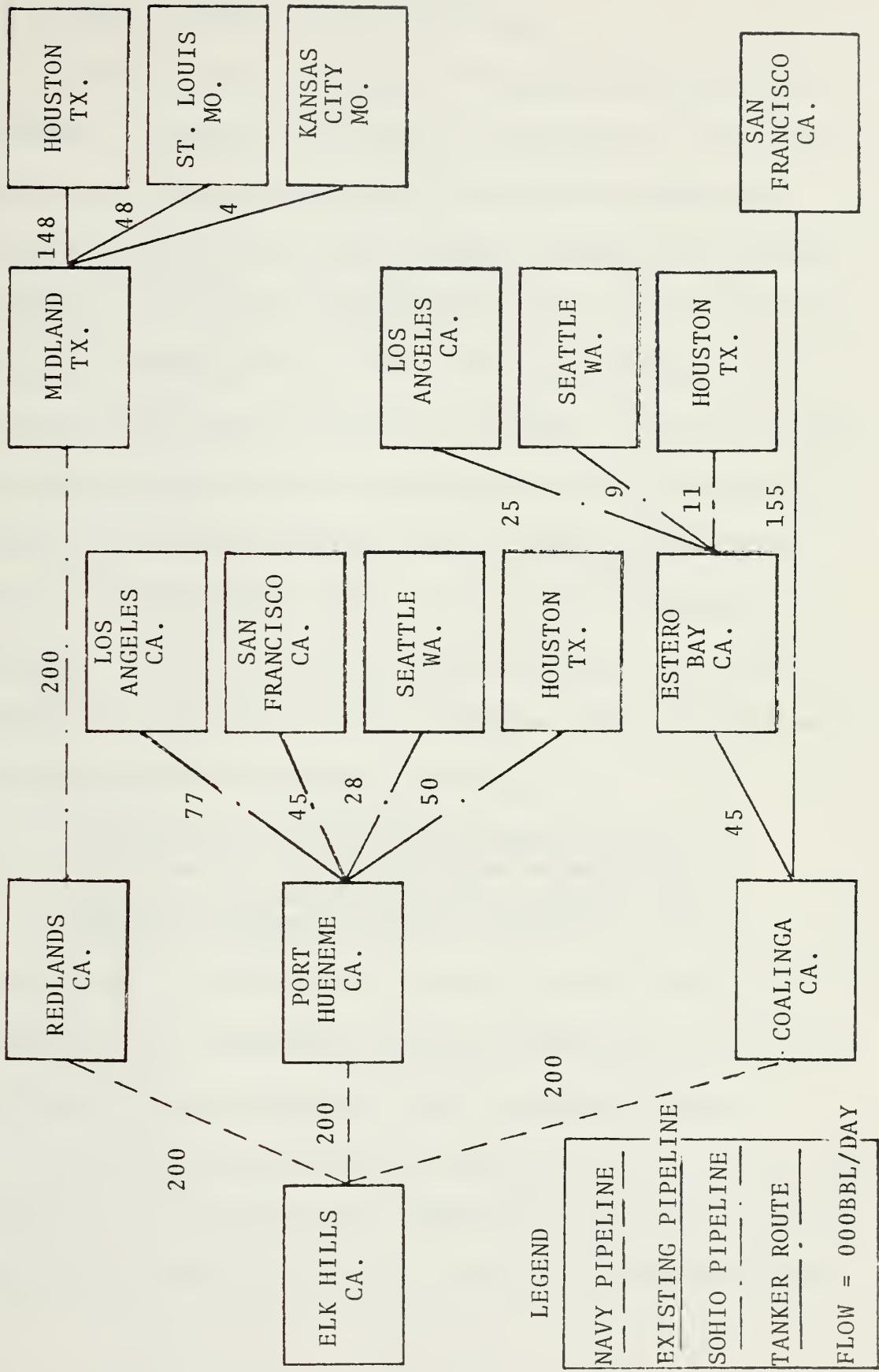
Los Angeles, California, 74% (25,000 barrels per day);

Seattle, Washington, 26% (9,000 barrels per day)

[Ref. 6, p. 53].

As an aid in summarizing the refinery areas and flow quantities for NPR-1 crude, Figure 2 is presented.

FIGURE 2 LOCATION AND FLOW OF NPR-1 CRUDE



2. Price of Crude at Refinery Markets

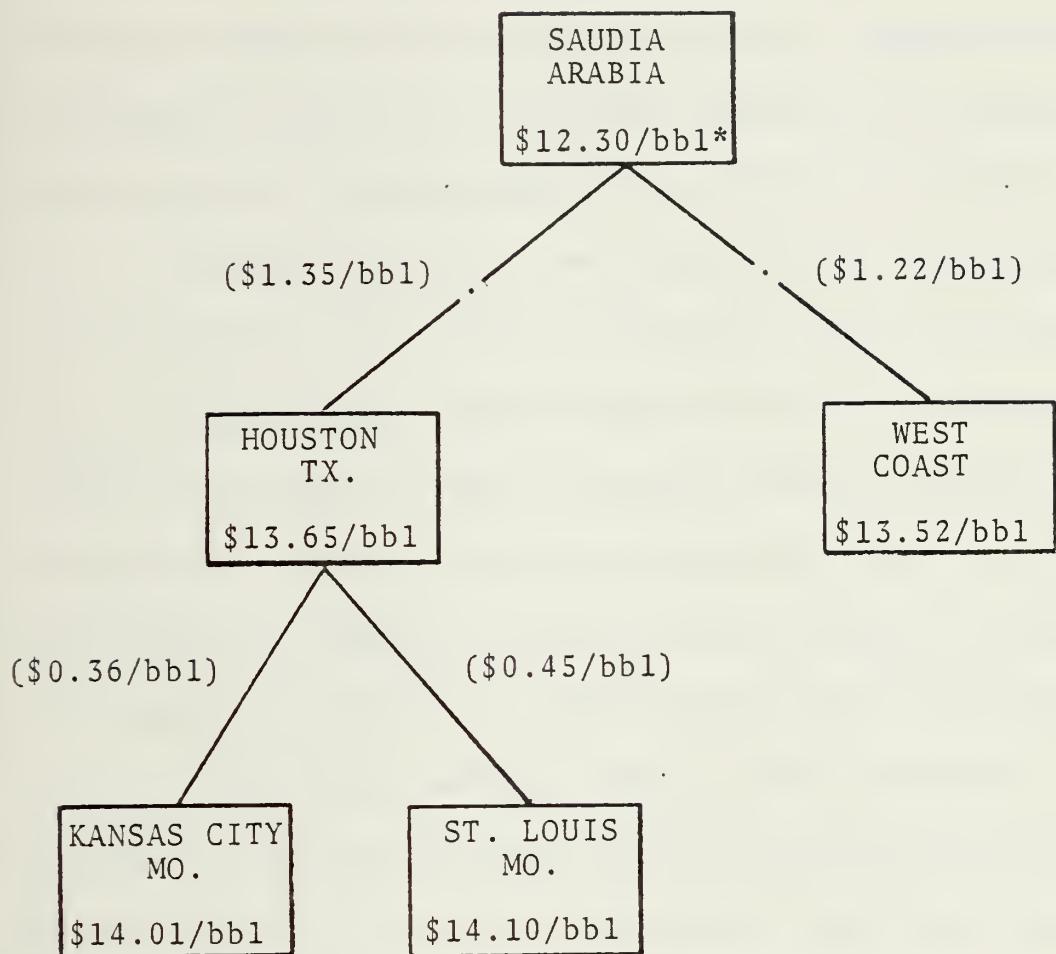
Next the price of crude oil at the specific refinery locations is calculated. Attempts to discover the current price of crude oil by contacting the individual refineries in the desired locations failed. Discussion of this problem with economists at Standard Oil Company of California, revealed that available price data on crude oil is based solely on the location of the oil field. Since no regulatory agency requires posting of crude oil prices at refineries, prices for crude at refineries is generally not available outside of the oil company. The economists also indicated that the prices of crude at refineries is treated as proprietary information, and as such would probably be unavailable. Figure 3 presents a display showing the method used to determine the crude oil price at the refineries. This method is based on the following statement made by the FEA:

"The landed price of imported crude oil in the U.S. is the world or OPEC price, plus transportation costs to the refinery plus the 21-cents-per-barrel import fee imposed by the U.S." [Ref. 6, p. 335].

In other words, the OPEC price of crude oil, which is set F. O. B. the producer, plus transportation costs and import fees is the driving force behind the market price for crude at any given refinery.

The price of Saudia Arabian light crude (F. O. B. Saudia Arabia) is utilized as representative of the OPEC price. The main reason for choosing the Arabian light crude as a basis for comparison with NPR-1

FIGURE 3, CRUDE PRICING AT REFINERY LOCATIONS



LEGEND

Pipeline	<u>(Transportation Cost)</u>
Tanker Route	<u>(Transportation Cost)</u>

* \$12.30/bbl = Arabian
Light Crude FOB
Saudia Arabia (\$12.09/
bb1) plus U.S.
import tax (\$0.21/bbl)

crude is due to the similarity of the crudes. The Arabian light is rated at 34° API and the NPR-1 crude (Stevens Zone crude which accounts for 67% of the production) is rated at 35° API. On 1 January 1977, the posted price for Arabian light F.O.B. Saudia Arabia was \$12.09 per barrel. [Ref. 10]. To this amount the U.S. import fee of \$.21 per barrel is added giving a price of \$12.30 per barrel.

Transportation costs were then identified from Saudia Arabia to both Houston, Texas, and the West Coast. For each of these routes, use of tankers ranging in size from 80,000 to 160,000 deadweight tons (DWT) was assumed so that compatibility with port facilities would be maintained. The port of destination on the West Coast was assumed to be either Los Angeles, San Francisco, or Seattle. The differential in distance and rates between Saudia Arabia and the three West Coast ports is felt to be insignificant, resulting in the assumption of equal transportation costs to the three ports. The tariff for the trip to Houston is \$1.35 per barrel and to the West Coast is \$1.22 per barrel [Ref. 6, p. 155]. Existing pipelines were then used to establish transportation costs from Houston to St. Louis and Kansas City. The posted tariff from Houston to St. Louis is \$.45 and to Kansas City is \$.36 [Ref. 6, p. 224].

Thus we find that the projected price of Arabian light crude in each of the refinery areas is: West Coast - \$13.52; Houston, Texas, \$13.65; St. Louis, Missouri, \$14.10; and Kansas City, Missouri, \$14.01. This price should be further modified to account for the

physical differences between the Arabian light and NPR-1 crude. The physical characteristics, such as specific gravity, sulphur content, and product mix output, must be compared in order to adjust the prices of crude oils to an equal basis. No data on this comparison between Arabian light and NPR-1 crude was found; therefore, no correction is offered for the difference in physical characteristics between the two crudes.

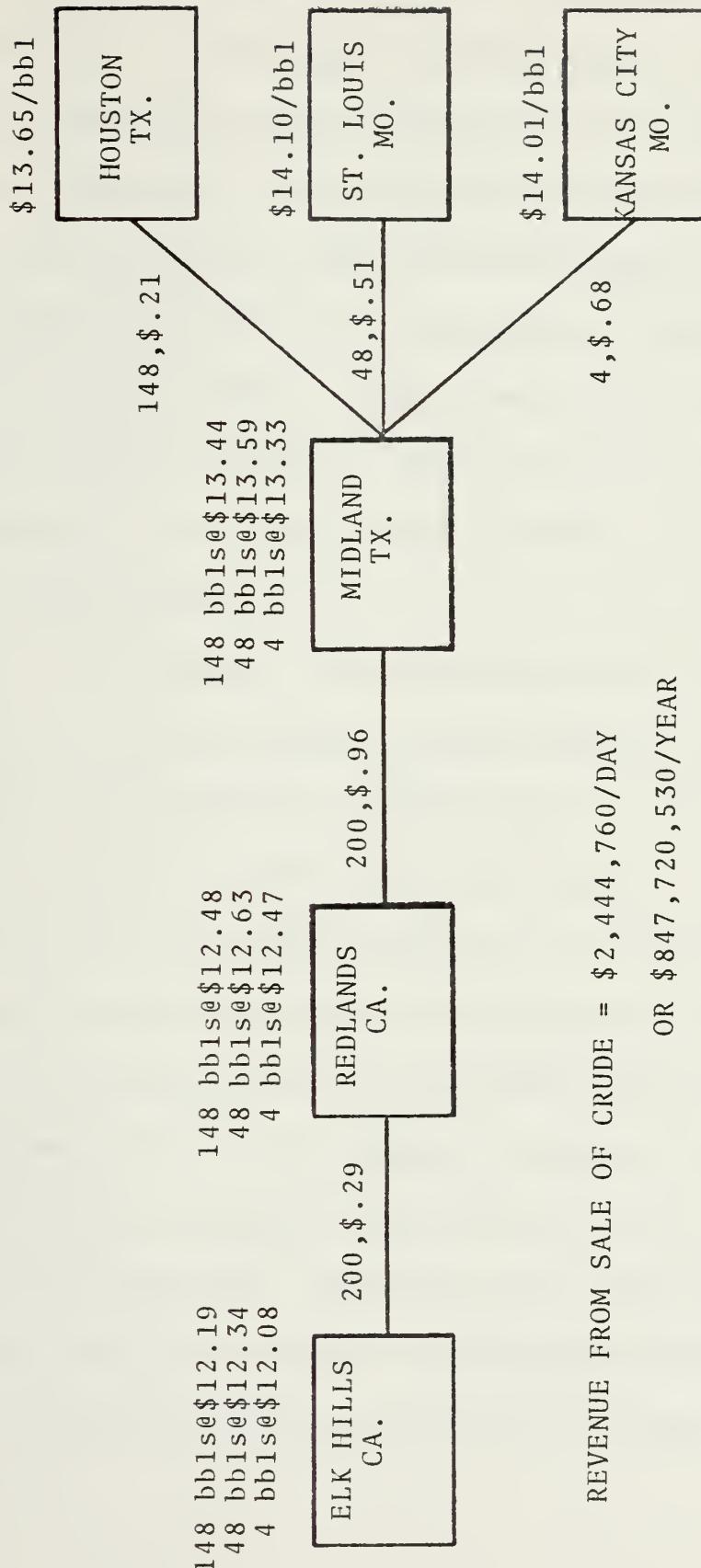
3. Transportation Costs and Total Revenue

The next step in application of the methodology is to identify transportation costs incurred in moving the crude from NPR-1 to the refineries, and to determine the total revenue from the sale of the crude for each alternative. In order to accomplish these tasks, each alternative will be considered separately.

a. Alternative A

Figure 4 presents a display of the flows, transportation costs, and crude prices at the refineries for Alternative A. The first leg of the transportation system is the proposed Navy pipeline from Elk Hills to Redlands, California. As previously discussed in Chapter 3, the tariff for this pipeline is computed on a cost of service approach, based on a 20% factor on the total investment cost. Using a flow rate of 200,000 barrels per day and assuming that the utilization factor on the pipeline is 95%, the tariff is projected to be \$0.29 per barrel.

FIGURE 4 ALTERNATIVE A



REVENUE FROM SALE OF CRUDE = \$2,444,760/DAY
OR \$847,720,530/YEAR

TRANSPORTATION
SYSTEM

FLOW IN 000 BBLs/DAY, TARIFF IN \$/BBL

Next, the crude will move from Redlands, California, to Midland, Texas, via the proposed SOHIO pipeline. The FEA has projected the tariff for the entire SOHIO pipeline (from Long Beach, California, to Midland, Texas) to be \$1.00 per barrel [Ref. 6, p. 281]. Since the crude from NPR-1 will be transported only from Redlands, a lesser tariff can be anticipated. On the basis of mileage, the distance between Redlands and Midland is approximately 96% of the distance between Long Beach and Midland. Using this mileage percentage as a basis to project the tariff from Redlands to Midland, the projected tariff is \$0.96 per barrel.

From Midland, existing pipelines will be used to transport the crude to the refinery locations. Posted tariffs for the existing pipelines have been identified by the FEA [Ref. 6, p. 224]. Exact tariffs are posted for the Midland to Houston segment, but for the Midland to St. Louis and Midland to Kansas City segments, a mileage proportion of the tariff from Midland to Minneapolis is used.

The price of the crude at specific refinery locations is transferred from Figure 3 to the refinery locations on Figure 4. For each refinery location and flow, the transportation costs are then subtracted back to Elk Hills. Calculation of the total annual revenue from the sale of the crude is based on 95% utilization of the Navy pipeline. The total projected annual revenue for Alternative A is \$847,720,530.

b. Alternative B

Figure 5 displays the flows, transportation costs, and crude prices at refineries for Alternative B. Again, the first leg of the transportation system is the proposed Navy pipeline from Elk Hills to Port Hueneme, California. The tariff for this pipeline, based on the cost of service approach, is \$0.25 per barrel. The cost of transportation via tanker from Port Hueneme to the refinery areas is based on data supplied in a Navy funded study of transportation alternatives [Ref. 12, p. B-9].

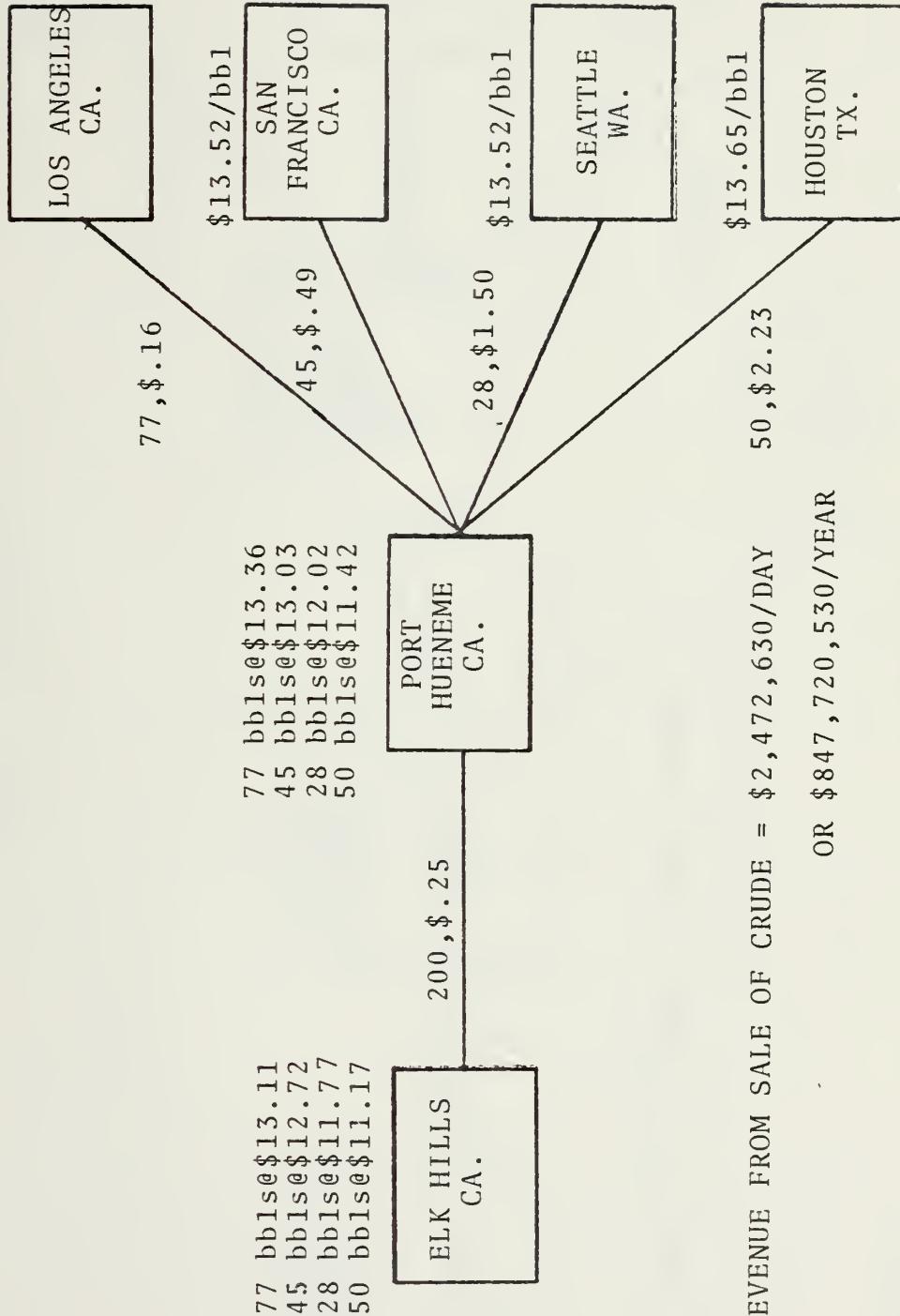
As before, the crude prices in the refinery locations is transferred from Figure 3 to Figure 5 and then transportation costs for each route are subtracted from the refinery price. The projected annual revenue from the sale of crude from Alternative B is \$857,384,453.

c. Alternative C

Figure 6 presents the flows, transportation costs, and crude prices at the refineries for Alternative C. The tariff for the first segment of the system, the proposed Navy pipeline from Elk Hills to Coalinga, is based on the previously described cost of service approach. The tariff from Coalinga to San Francisco is based on existing rates, as is the tariff from Coalinga to Estero Bay [Ref. 12, p. B-9].

FIGURE 5 ALTERNATIVE B

\$13.52/bbl

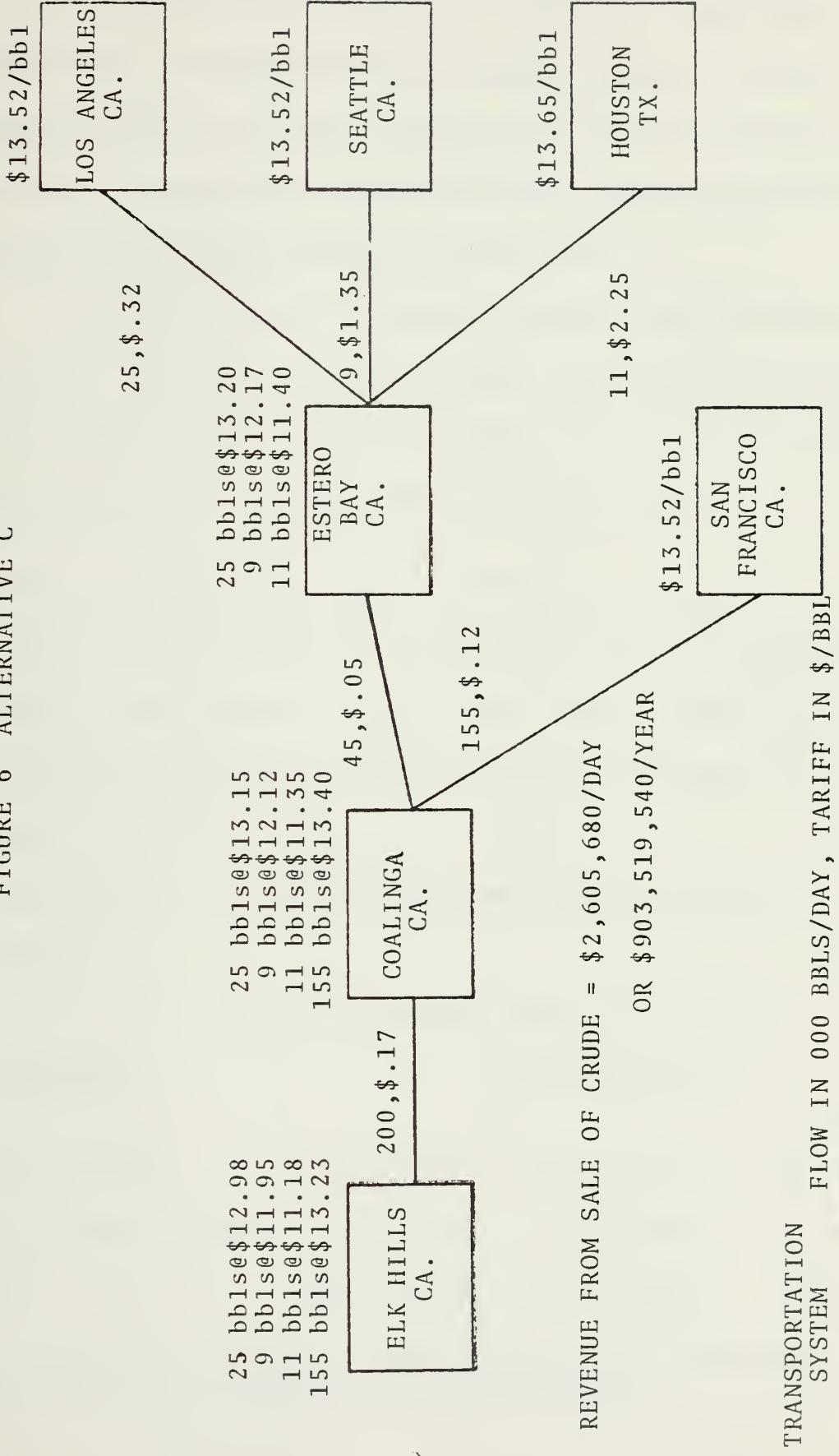


REVENUE FROM SALE OF CRUDE = \$2,472,630/DAY

OR \$847,720,530/YEAR

TRANSPORTATION FLOW IN 000 BBLs/DAY, TARIFF IN \$/BBL
SYSTEM

FIGURE 6 ALTERNATIVE C



Difficulty was encountered in obtaining transportation costs via tanker from Estero Bay to the refinery areas. The rates used for Alternative B in tanker transportation from Port Hueneme were used as a base and were modified slightly, based on the difference in location between Port Hueneme and Estero Bay.

Crude prices at the refinery locations were transferred from Figure 3 to Figure 6 and transportation costs were subtracted from the refinery prices. The total annual revenue from the sale of crude from Alternative C is calculated to be \$903,519,540.

C. REVENUE FROM OPERATION OF THE NAVY PIPELINE

The next item of revenue to be considered is that derived from the sale of the Navy pipeline service. This amount is simply the proposed tariff for each alternative pipeline route multiplied by the projected flow for the pipeline.

Table 2 presents a summary of all the revenues identified in this analysis.

Table 2. REVENUE SUMMARY

REVENUE	ALTERNATIVE		
	A	B	C
SALE OF CRUDE*	847,720,530	857,384,453	903,519,540
PIPELINE OPERATIONS*	20,111,500	17,337,500	11,789,500
TOTAL	867,832,030	874,721,953	915,309,040

*Calculation based on flow of 200,000 barrels per day with pipeline utilization of 95% (annual flow = 69,350,000 barrels)

D. NET REVNUE CALCULATIONS

The final step in the application of the proposed methodology is to aggregate costs and revenues and compare the net revenues of each alternative. Table 3 presents the net revenues from each alternative.

Table 3. NET REVENUE SUMMARY

	ALTERNATIVE		
	A	B	C
REVENUE	\$867,832,030	\$874,721,953	\$915,309,040
COST	\$ 14,470,000	\$ 12,792,500	\$ 9,822,000
NET REVENUE	\$853,362,030	\$861,929,453	\$905,487,040

Comparison of the net revenue figures shows that Alternative C will provide maximum net revenue. Again, the point is made that many assumptions and extractions of data surround the figures used in obtaining the net revenue amounts. The relatively small spread of the total figures indicates that even slight modifications to certain assumptions in the application process might cause a reordering of the alternative ranking. The numbers used in the application process are best thought of as an illustration of the proposed methodology rather than as a basis for actual choice.

V. SUMMARY, COMMENTS, AND RECOMMENDATIONS

The approach used in building the methodology to make the alternative choice at NPR-1, Elk Hills is basically one of applying a cost and revenue determination model to the concept of maximizing the net revenue from the system. Costs are identified based on existing engineering studies for each alternative. Revenue determination is comprised of two parts, that from the sale of the crude oil and that from the operation from the Navy pipeline. The revenue from the sale of the crude is calculated by determining the market price of crude oil at specific refinery locations and then subtracting the transportation costs from the refinery to NPR-1, giving the price of the crude at NPR-1. Then by multiplying the price of the crude at NPR-1 by the flow rate, revenue from sale of the crude is determined. Pipeline operation revenue is calculated by multiplying the tariff by the flow. Aggregation of these costs and revenues then gives net revenue, with the choice of the alternatives based on the maximum value of this amount.

In attempting to apply the methodology in a rigorous manner, numerous difficulties were encountered. The complexity and size of the petroleum and petroleum transportation industries necessitated numerous assumptions. As a result of the large number of assumptions and data extractions required in determining the specific factors of

the methodology, the application of facts and figures to the model is presented as an illustration of a methodology rather than a rigorous application resulting in a concrete alternative recommendation.

Future study in this area with this thesis as a base may prove fruitful. A refinement of the application of the methodology would be a first step. A rigorous application of market forces and transportation costs to the methodology would result in net revenue figures which would be more meaningful toward the actual choice of alternatives.

Associated with this more rigorous application would be a sensitivity analysis, that is a variation of the key parameters to see how much variation is needed to change the alternative choice from one to another. The variables which appear to have major impact on the net revenue include the quantity of oil flowing through the Navy pipeline, the particular refinery markets served, and the world (or OPEC) price of crude oil. These and perhaps other variables could be studied in depth to determine the effect that changes in the variables have on net revenue and alternative choice. Utilization of network theory and computer analysis might be of assistance in performing the sensitivity analysis since a large number of variable factors can be identified.

The proposed methodology might also be used to maximize revenue from the pipeline system which is chosen for installation. Since each alternative presents choices for refinery market locations and transportation routes, the methodology could be applied to the chosen alternative in order to maximize revenue from that system.

Because of the net revenue problem structure it might even be that the best solution is not to build just one pipeline but all three or a combination of two. The rationale for this being that a dynamic allocation of flow based on the fluctuation of market prices might yield a maximum net revenue if a combination of two or all three pipelines are built. This problem in particular is amenable to computer-network theory simulation.



Public Law 94-258
94th Congress, H. R. 49
April 5, 1976

1976

An Act

To authorize the Secretary of the Interior to establish on certain public lands of the United States national petroleum reserves the development of which needs to be regulated in a manner consistent with the total energy needs of the Nation, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Naval Petroleum Reserves Production Act of 1976".

TITLE I—NATIONAL PETROLEUM RESERVE IN ALASKA

DEFINITION

SEC. 101. As used in this title, the term "petroleum" includes crude oil, gases (including natural gas), natural gasoline, and other related hydrocarbons, oil shale, and the products of any of such resources.

Naval
Petroleum
Reserves
Production
Act of 1976.
42 USC 6501
note.

42 USC 6501.

DESIGNATION OF THE NATIONAL PETROLEUM RESERVE IN ALASKA

SEC. 102. The area known as Naval Petroleum Reserve Numbered 4, Alaska, established by Executive order of the President, dated February 27, 1923, except for tract Numbered 1 as described in Public Land Order 2344, dated April 24, 1961, shall be transferred to and administered by the Secretary of the Interior in accordance with the provisions of this Act. Effective on the date of transfer all lands within such area shall be redesignated as the "National Petroleum Reserve in Alaska" (hereinafter in this title referred to as the "reserve"). Subject to valid existing rights, all lands within the exterior boundaries of such reserve are hereby reserved and withdrawn from all forms of entry and disposition under the public land laws, including the mining and mineral leasing laws, and all other Acts; but the Secretary is authorized to (1) make dispositions of mineral materials pursuant to the Act of July 31, 1947 (61 Stat. 681), as amended (30 U.S.C. 601), for appropriate use by Alaska Natives, (2) make such dispositions of mineral materials and grant such rights-of-way, licenses, and permits as may be necessary to carry out his responsibilities under this Act, and (3) convey the surface of lands properly selected on or before December 18, 1975, by Native village corporations pursuant to the Alaska Native Claims Settlement Act. All other provisions of law heretofore enacted and actions heretofore taken reserving such lands as a Naval Petroleum Reserve shall remain in full force and effect to the extent not inconsistent with this Act.

42 USC 6502.

43 CFR app.

43 USC 1601
note.

TRANSFER OF JURISDICTION

SEC. 103. (a) Jurisdiction over the reserve shall be transferred by the Secretary of the Navy to the Secretary of the Interior on June 1, 1977.

(b) With respect to any activities related to the protection of environmental, fish and wildlife, and historical or scenic values, the Secretary of the Interior shall assume all responsibilities as of the date

Rules and regulations.

of the enactment of this title. As soon as possible, but not later than the effective date of transfer, the Secretary of the Interior may promulgate such rules and regulations as he deems necessary and appropriate for the protection of such values within the reserve.

(c) The Secretary of the Interior shall, upon the effective date of the transfer of the reserve, assume the responsibilities and functions of the Secretary of the Navy under any contracts which may be in effect with respect to activities within the reserve.

(d) On the date of transfer of jurisdiction of the reserve, all equipment, facilities, and other property of the Department of the Navy used in connection with the operation of the reserve, including all records, maps, exhibits, and other informational data held by the Secretary of the Navy in connection with the reserve, shall be transferred without reimbursement from the Secretary of the Navy to the Secretary of the Interior who shall thereafter be authorized to use them to carry out the provisions of this title.

(e) On the date of transfer of jurisdiction of the reserve, the Secretary of the Navy shall transfer to the Secretary of the Interior all unexpended funds previously appropriated for use in connection with the reserve and all civilian personnel ceilings assigned by the Secretary of the Navy to the management and operation of the reserve as of January 1, 1976.

ADMINISTRATION OF THE RESERVE

Petroleum production, prohibition. 42 USC 6504.

Explorations.

SEC. 104. (a) Except as provided in subsection (e) of this section, production of petroleum from the reserve is prohibited and no development leading to production of petroleum from the reserve shall be undertaken until authorized by an Act of Congress.

(b) Any exploration within the Utukok River, the Teshekpuk Lake areas, and other areas designated by the Secretary of the Interior containing any significant subsistence, recreational, fish and wildlife, or historical or scenic value, shall be conducted in a manner which will assure the maximum protection of such surface values to the extent consistent with the requirements of this Act for the exploration of the reserve.

(c) The Secretary of the Navy shall continue the ongoing petroleum exploration program within the reserve until the date of the transfer of jurisdiction specified in section 103(a). Prior to the date of such transfer of jurisdiction the Secretary of the Navy shall—

(1) cooperate fully with the Secretary of the Interior providing him access to such facilities and such information as he may request to facilitate the transfer of jurisdiction;

(2) provide to the Committees on Interior and Insular Affairs of the Senate and the House of Representatives copies of any reports, plans, or contracts pertaining to the reserve that are required to be submitted to the Committees on Armed Services of the Senate and the House of Representatives; and

(3) cooperate and consult with the Secretary of the Interior before executing any new contract or amendment to any existing contract pertaining to the reserve and allow him a reasonable opportunity to comment on such contract or amendment, as the case may be.

(d) The Secretary of the Interior shall commence further petroleum exploration of the reserve as of the date of transfer of jurisdiction specified in section 103(a). In conducting this exploration effort, the Secretary of the Interior—

(1) is authorized to enter into contracts for the exploration of the reserve, except that no such contract may be entered into until

Information, submittal to congressional committees.

Contracts.

at least thirty days after the Secretary of the Interior has provided the Attorney General with a copy of the proposed contract and such other information as may be appropriate to determine legal sufficiency and possible violations under, or inconsistencies with, the antitrust laws. If, within such thirty day period, the Attorney General advises the Secretary of the Interior that any such contract would unduly restrict competition or be inconsistent with the antitrust laws, then the Secretary of the Interior may not execute that contract;

(2) shall submit to the Committees on Interior and Insular Affairs of the Senate and the House of Representatives any new plans or substantial amendments to ongoing plans for the exploration of the reserve. All such plans or amendments submitted to such committees pursuant to this section shall contain a report by the Attorney General of the United States with respect to the anticipated effects of such plans or amendments on competition. Such plans or amendments shall not be implemented until sixty days after they have been submitted to such committees; and

(3) shall report annually to the Committees on Interior and Insular Affairs of the Senate and the House of Representatives on the progress of, and future plans for, exploration of the reserve.

(e) Until the reserve is transferred to the jurisdiction of the Secretary of the Interior, the Secretary of the Navy is authorized to develop and continue operation of the South Barrow gas field, or such other fields as may be necessary, to supply gas at reasonable and equitable rates to the native village of Barrow, and other communities and installations at or near Point Barrow, Alaska, and to installations of the Department of Defense and other agencies of the United States located at or near Point Barrow, Alaska. After such transfer, the Secretary of the Interior shall take such actions as may be necessary to continue such service to such village, communities, installations, and agencies at reasonable and equitable rates.

Plans, submittal to congressional committees.
Report by Attorney General.

Report to congressional committees.

SEC. 105. (a) Section 164 of the Energy Policy and Conservation Act (89 Stat. 871, 889), is hereby amended by deleting in the first sentence "to the Congress" and by inserting in lieu thereof "to the Committees on Interior and Insular Affairs of the Senate and House of Representatives".

42 USC 6244.

(b) (1) The President shall direct such Executive departments and/or agencies as he may deem appropriate to conduct a study, in consultation with representatives of the State of Alaska, to determine the best overall procedures to be used in the development, production, transportation, and distribution of petroleum resources in the reserve. Such study shall include, but shall not be limited to, a consideration of—

42 USC 6505.

(A) the alternative procedures for accomplishing the development, production, transportation, and distribution of the petroleum resources from the reserve, and

(B) the economic and environmental consequences of such alternative procedures.

(2) The President shall make semiannual progress reports on the implementation of this subsection to the Committees on Interior and Insular Affairs of the Senate and the House of Representatives beginning not later than six months after the date of the enactment of this Act and shall, not later than one year after the transfer of jurisdiction of the reserve, and annually thereafter, report any findings or

Report to congressional committees.

conclusions developed as a result of such study together with appropriate supporting data and such recommendations as he deems desirable. The study shall be completed and submitted to such committees, together with recommended procedures and any proposed legislation necessary to implement such procedures not later than January 1, 1980.

42 USC 6505.

(c) (1) The Secretary of the Interior shall establish a task force to conduct a study to determine the values of, and best uses for, the lands contained in the reserve, taking into consideration (A) the natives who live or depend upon such lands, (B) the scenic, historical, recreational, fish and wildlife, and wilderness values, (C) mineral potential, and (D) other values of such lands.

(2) Such task force shall be composed of representatives from the government of Alaska, the Arctic slope native community, and such offices and bureaus of the Department of the Interior as the Secretary of the Interior deems appropriate, including, but not limited to, the Bureau of Land Management, the United States Fish and Wildlife Service, the United States Geological Survey, and the Bureau of Mines.

Report to
congressional
committees.

(3) The Secretary of the Interior shall submit a report, together with the concurring or dissenting views, if any, of any non-Federal representatives of the task force, of the results of such study to the Committees on Interior and Insular Affairs of the Senate and the House of Representatives within three years after the date of enactment of this title and shall include in such report his recommendations with respect to the value, best use, and appropriate designation of the lands referred to in paragraph (1).

ANTITRUST PROVISIONS

42 USC 6506.

Post, p. 309.

SEC. 106. Unless otherwise provided by Act of Congress, whenever development leading to production of petroleum is authorized, the provisions of subsections (g), (h), and (i) of section 7430 of title 10, United States Code, shall be deemed applicable to the Secretary of the Interior with respect to rules and regulations, plans of development and amendments thereto, and contracts and operating agreements. All plans and proposals submitted to the Congress under this title or pursuant to legislation authorizing development leading to production shall contain a report by the Attorney General of the United States on the anticipated effects upon competition of such plans and proposals.

AUTHORIZATION FOR APPROPRIATIONS

42 USC 6507.

Community
municipal
services and
facilities,
Federal fi-
nancial
assistance.

SEC. 107. (a) There are authorized to be appropriated to the Department of the Interior such sums as may be necessary to carry out the provisions of this title.

(b) If the Secretary of the Interior determines that there is an immediate and substantial increase in the need for municipal services and facilities in communities located on or near the reserve as a direct result of the exploration and study activities authorized by this title and that an unfair and excessive financial burden will be incurred by such communities as a result of the increased need for such services and facilities, then he is authorized to assist such communities in meeting the costs of providing increased municipal services and facilities. The Secretary of the Interior shall carry out the provisions of this section through existing Federal programs and he shall consult with the heads of the departments or agencies of the Federal Government concerned with the type of services and facilities for which financial assistance is being made available.

TITLE II—NAVAL PETROLEUM RESERVES

SEC. 201. Chapter 641 of title 10, United States Code, is amended as follows:

(1) Immediately before section 7421 insert the following new section:

“§ 7420. Definitions

10 USC 7420.

“(a) In this chapter—

“(1) ‘national defense’ includes the needs of, and the planning and preparedness to meet, essential defense, industrial, and military emergency energy requirements relative to the national safety, welfare, and economy, particularly resulting from foreign military or economic actions;

“(2) ‘naval petroleum reserves’ means the naval petroleum and oil shale reserves established by this chapter, including Naval Petroleum Reserve Numbered 1 (Elk Hills), located in Kern County, California, established by Executive order of the President, dated September 2, 1912; Naval Petroleum Reserve Numbered 2 (Buena Vista), located in Kern County, California, established by Executive order of the President, dated December 13, 1912; Naval Petroleum Reserve Numbered 3 (Teapot Dome), located in Wyoming, established by Executive order of the President, dated April 30, 1915; Naval Petroleum Reserve Numbered 4, Alaska, established by Executive order of the President, dated February 27, 1923 (until redesignated as the National Petroleum Reserve in Alaska under the jurisdiction of the Secretary of the Interior as provided in the Naval Petroleum Reserves Production Act of 1976); Oil Shale Reserve Numbered 1, located in Colorado, established by Executive order of the President, dated December 6, 1916, as amended by Executive order dated June 12, 1919; Oil Shale Reserve Numbered 2, located in Utah, established by Executive order of the President, dated December 6, 1916; and Oil Shale Reserve Numbered 3, located in Colorado, established by Executive order of the President, dated September 27, 1924;

“(3) ‘petroleum’ includes crude oil, gases (including natural gas), natural gasoline, and other related hydrocarbons, oil shale, and the products of any of such resources;

“(4) ‘Secretary’ means the Secretary of the Navy;

“(5) ‘small refiner’ means an owner of a refinery or refineries (including refineries not in operation) who qualifies as a small business refiner under the rules and regulations of the Small Business Administration; and

“(6) ‘maximum efficient rate’ means the maximum sustainable daily oil or gas rate from a reservoir which will permit economic development and depletion of that reservoir without detriment to the ultimate recovery.”

(2) Section 7421(a) is amended—

10 USC 7421.

(A) by striking out “of the Navy”;

(B) by striking out “and oil shale”;

(C) by striking out “for naval purposes” and inserting in lieu thereof “for national defense purposes”; and

(D) by striking out “section 7438 hereof” and inserting in lieu thereof “this chapter”.

(3) The text of section 7422 is amended to read as follows:

10 USC 7422.

“(a) The Secretary, directly or by contract, lease, or otherwise, shall explore, prospect, conserve, develop, use, and operate the naval petroleum reserves in his discretion, subject to the provisions of subsection

(c) and the other provisions of this chapter; except that no petroleum leases shall be granted at Naval Petroleum Reserves Numbered 1 and 3.

"(b) Except as otherwise provided in this chapter, particularly subsection (c) of this section, the naval petroleum reserves shall be used and operated for—

"(1) the protection, conservation, maintenance, and testing of those reserves; or

"(2) the production of petroleum whenever and to the extent that the Secretary, with the approval of the President, finds that such production is needed for national defense purposes and the production is authorized by a joint resolution of Congress.

"(c)(1) In administering Naval Petroleum Reserves Numbered 1, 2, and 3, the Secretary is authorized and directed—

"(A) to further explore, develop, and operate such reserves;

"(B) commencing within ninety days after the date of enactment of the Naval Petroleum Reserves Production Act of 1976, to produce such reserves at the maximum efficient rate consistent with sound engineering practices for a period not to exceed six years after the date of enactment of such Act;

"(C) during such production period or any extension thereof to sell or otherwise dispose of the United States share of such petroleum produced from such reserves as hereinafter provided; and

"(D) to construct, acquire, or contract for the use of storage and shipping facilities on and off the reserves and pipelines and associated facilities on and off the reserves for transporting petroleum from such reserves to the points where the production from such reserves will be refined or shipped.

Any pipeline in the vicinity of a naval petroleum reserve not otherwise operated as a common carrier may be acquired by the Secretary by condemnation, if necessary, if the owner thereof refuses to accept, convey, and transport without discrimination and at reasonable rates any petroleum produced at such reserve. With the approval of the Secretary, rights-of-way for new pipelines and associated facilities may be acquired by the exercise of the right of eminent domain in the appropriate United States district court. Such rights-of-way may be acquired in the manner set forth in the Act of February 26, 1931, chapter 307 (46 Stat. 1421; 40 U.S.C. 258(a)), and the prospective holder of the right-of-way is 'the authority empowered by law to acquire the lands' within the meaning of that Act. Such new pipelines shall accept, convey, and transport without discrimination and at reasonable rates any petroleum produced at such reserves as a common carrier. Pipelines and associated facilities constructed at or procured for Naval Petroleum Reserve Numbered 1 pursuant to this subsection shall have adequate capacity to accommodate not less than three hundred fifty thousand barrels of oil per day and shall be fully operable as soon as possible, but not later than three years after the date of enactment of the Naval Petroleum Reserves Production Act of 1976.

"(2) At the conclusion of the six-year production period authorized by paragraph (1)(B) of this subsection the President may extend the period of production in the case of any naval petroleum reserve for additional periods of not to exceed three years each—

"(A) after the President requires an investigation to be made, in the case of each extension, to determine the necessity for continued production from such naval petroleum reserve;

"(B) after the President submits to the Congress, at least one hundred eighty days prior to the expiration of the current production period prescribed by this section, or any extension thereof,

Investigation.

Report to
Congress.

a copy of the report made to him on such investigation together with a certification by him that continued production from such naval petroleum reserve is in the national interest; and

“(C) if neither House of Congress within ninety days after receipt of such report and certification adopts a resolution disapproving further production from such naval petroleum reserve.

“(3) The production authorization set forth in paragraph (1)(B) of this subsection, in the case of Naval Petroleum Reserve Numbered 1, is conditioned upon the private owner of any lands or interests therein within such reserve agreeing with the Secretary to continue operations of such reserve under a unitized plan contract which adequately protects the public interest; however, if such agreement is not reached within ninety days after the date of enactment of the Naval Petroleum Reserves Production Act of 1976 the Secretary is authorized to exercise the authority for condemnation conferred by section 7425 of this chapter.”.

(4) The first sentence of section 7423 is amended by deleting “of the Navy” and “or products”.

10 USC 7423.

(5) Section 7424 is amended—

10 USC 7424.

(A) by deleting “of the Navy” in the text of subsection (a) preceding clause (1);

(B) by deleting “and oil shale” in subsection (a)(1) in the text preceding subclause (A); and

(C) by deleting “in the ground” in clause (1)(A) of subsection (a).

(6) Section 7425 is amended by deleting “of the Navy”.

10 USC 7425.

(7) Section 7426(a) is amended by striking out “the Secretary of the Navy” and inserting in lieu thereof “Subject to the provisions of section 7422(c), the Secretary”.

10 USC 7426.

(8) The first and second sentences of section 7427 are amended by striking out “of the Navy”.

10 USC 7427.

(9) Section 7428 is amended by striking out “within the naval petroleum and oil shale reserves shall contain a provision authorizing the Secretary of the Navy” and inserting in lieu thereof “within Naval Petroleum Reserve Numbered 2 and the oil shale reserves shall contain a provision authorizing the Secretary”.

10 USC 7428.

(10) The first sentence of section 7429 is amended by deleting “of the Navy”.

10 USC 7429.

(11) The text of section 7430 is amended to read as follows:

10 USC 7430.

“(a) In administering the naval petroleum reserves under this chapter, the Secretary shall use, store, or sell the petroleum produced from the naval petroleum reserves and lands covered by joint, unit, or other cooperative plans.

“(b) Notwithstanding any other provision of law, each sale of the United States share of petroleum shall be made by the Secretary at public sale to the highest qualified bidder, for periods of not more than one year, at such time, in such amounts, and after such advertising as the Secretary considers proper and without regard to Federal, State, or local regulations controlling sales or allocation of petroleum products.

Public sale.

“(c) In no event shall the Secretary permit the award of any contract which would result in any person obtaining control, directly or indirectly, over more than 20 per centum of the estimated annual United States share of petroleum produced from Naval Petroleum Reserve Numbered 1.

“(d) Each proposal for sale under this title shall provide that the terms of every sale of the United States share of petroleum from the naval petroleum reserves shall be so structured as to give full and

equal opportunity for the acquisition of petroleum by all interested persons, including major and independent oil producers and refiners alike. When the Secretary, in consultation with the Secretary of the Interior, determines that the public interests will be served by the sale of petroleum to small refiners not having their own adequate sources of supply of petroleum, the Secretary is authorized and directed to set aside a portion of the United States share of petroleum produced for sale to such refiners under the provisions of this section for processing or use in such refineries, except that—

“(1) none of the production sold to small refiners may be resold in kind;

“(2) production must be sold at a cost of not less than the prevailing local market price of comparable petroleum;

“(3) the set-aside portion may not exceed 25 per centum of the estimated annual United States share of the total production from all producing naval petroleum reserves; and

“(4) notwithstanding the provisions of subsection (b) of this section, the Secretary may, at his discretion if he deems it to be in the public interest, prorate such petroleum among such refiners for sale, without competition, at not less than the prevailing local market price of comparable petroleum.

“(e) Any petroleum produced from the naval petroleum reserves, except such petroleum which is either exchanged in similar quantities for convenience or increased efficiency of transportation with persons or the government of an adjacent foreign state, or which is temporarily exported for convenience or increased efficiency of transportation across parts of an adjacent foreign state and reenters the United States, shall be subject to all of the limitations and licensing requirements of the Export Administration Act of 1969 (83 Stat. 841) and, in addition, before any petroleum subject to this section may be exported under the limitations and licensing requirement and penalty and enforcement provisions of the Export Administration Act of 1969, the President must make and publish an express finding that such exports will not diminish the total quality or quantity of petroleum available to the United States and that such exports are in the national interest and are in accord with the Export Administration Act of 1969.

“(f) During the period of production or any extension thereof authorized by section 7422(e), the consultation and approval requirements of section 7431(a) (3) are waived.

“(g) (1) Prior to the promulgation of any rules and regulations, plans of development and amendments thereto, and in the entering and making of contracts and operating agreements relating to the development, production, or sale of petroleum in or from the reserves, the Secretary shall consult with and give due consideration to the views of the Attorney General of the United States with respect to matters which may affect competition.

“(2) No contract or operating agreement may be made, issued, or executed under this chapter until at least thirty days after the Secretary notifies the Attorney General of the proposed contract or operating agreement. Such notification shall contain such information as the Attorney General may require in order to advise the Secretary as to whether such contract or operating agreement may create or maintain a situation inconsistent with the antitrust laws. If, within such thirty day period, the Attorney General advises the Secretary that a contract or operating agreement may create or maintain a situation inconsistent with the antitrust laws, then the Secretary may not make, issue, or execute that contract or operating agreement.

50 USC app.
2401 note.

Waiver.
Ante, p. 307.
Post, p. 311.

Rules and
regulations.

Contract or
operating
agreement,
notification.

"(h) Nothing in this chapter shall be deemed to confer on any person immunity from civil or criminal liability, or to create defenses to actions, under the antitrust laws.

"(i) As used in this section, the term 'antitrust laws' means—

"(1) the Act entitled 'An Act to protect trade and commerce against unlawful restraints and monopolies', approved July 2, 1890 (15 U.S.C. 1 et seq.), as amended;

"(2) the Act entitled 'An Act to supplement existing laws against unlawful restraints and monopolies, and for other purposes', approved October 15, 1914 (15 U.S.C. 12 et seq.), as amended;

"(3) the Federal Trade Commission Act (15 U.S.C. 41 et seq.), as amended;

"(4) sections 73 and 74 of the Act entitled 'An Act to reduce taxation, to provide revenue for the Government, and for other purposes', approved August 27, 1894 (15 U.S.C. 8 and 9), as amended; or

"(5) sections 2, 3, and 4 of the Act of June 19, 1936, chapter 592 (15 U.S.C. 13a, 13b, and 21a).

"(j) Any pipeline which accepts, conveys, or transports any petroleum produced from Naval Petroleum Reserves Numbered 1 or Numbered 3 shall accept, convey, and transport without discrimination and at reasonable rates any such petroleum as a common carrier insofar as petroleum from such reserves is concerned. Every contract entered into by the Secretary for the sale of any petroleum owned by the United States which is produced from such reserves shall contain provisions implementing the requirements of the preceding sentence if the contractor owns a controlling interest in any pipeline or any company operating any pipeline, or is the operator of any pipeline, which carries any petroleum produced from such naval petroleum reserves. The Secretary may promulgate rules and regulations for the purpose of carrying out the provisions of this section and he, or the Secretary of the Interior where the authority extends to him, may declare forfeit any contract, operating agreement, right-of-way, permit, or easement held by any person violating any such rule or regulation. This section shall not apply to any natural gas common carrier pipeline operated by any person subject to regulation under the Natural Gas Act or any public utility subject to regulation by a State or municipal regulatory agency having jurisdiction to regulate the rates and charges for the sale of natural gas to consumers within the State or municipality.

"(k) The President may, at his discretion, direct that all or any part of the United States share of petroleum produced from the naval petroleum reserves be placed in strategic storage facilities as authorized by sections 151 through 166 of the Energy Policy and Conservation Act or that all or any part of such share be exchanged for petroleum of equal value for the purpose of placing such petroleum in such strategic storage facilities."

(12) Section 7431 is amended—

(A) by inserting "(a)" immediately before "The Committees";

(B) by striking out "or oil shale" in clauses (1) and (2);

(C) by striking out "and oil shale" in clauses (2) and (3);

(D) by striking out "oil and gas (other than royalty oil and gas), oil shale, and products therefrom" in clause (3) and inserting in lieu thereof "petroleum (other than royalty oil and gas)"; and

(E) by adding at the end thereof the following new subsections:

"(b) (1) During the period of production authorized by section

"Antitrust
laws."

Rules and
regulations.

15 USC 717w.

42 USC 6231-
6246.

10 USC 7431.

Ante, p. 307.
Report to congressional committees.

Report to Congress.

Reports to congressional committees.

10 USC 7432.

10 USC 7433.

7422(c), the Secretary shall submit to the Committees on Armed Services of the Senate and the House of Representatives any new plans or substantial amendments to ongoing plans for the exploration, development, and production of the naval petroleum reserves.

"(2) All plans or substantial amendments submitted to the Congress pursuant to this section shall contain a report by the Attorney General of the United States with respect to the anticipated effects of such plans or amendments on competition. Such plans or amendments shall not be implemented until sixty days after such plans or amendments have been submitted to such committees.

"(c) During the period of production authorized by section 7422(c), the Secretary shall submit annual reports as of the first day of the fiscal year to the Committees on Armed Services of the Senate and the House of Representatives, and such committees shall cause such reports to be printed as a Senate or House document, as appropriate. The Secretary shall include in such reports, with respect to each naval petroleum reserve, an explanation in detail of the following:

"(1) the status of the exploration, development, and production programs;

"(2) the production that has been achieved, including the disposition of such production and the proceeds realized therefrom;

"(3) the status of pipeline construction and procurement and problems related to the availability of transportation facilities;

"(4) a summary of future plans for exploration, development, production, disposal, and transportation of the production from the naval petroleum reserves; and

"(5) such other information regarding the reserve as the Secretary deems appropriate."

(13) Section 7432 is amended to read as follows:

§ 7432. Naval petroleum reserves special account

"(a) There is hereby established on the books of the Treasury Department a special account designated as the 'naval petroleum reserves special account'. There shall be credited to such account—

"(1) all proceeds realized under this chapter from the disposition of the United States share of petroleum;

"(2) the net proceeds, if any, realized from sales or exchanges within the Department of Defense of refined petroleum products accruing to the benefit of any component of that department as the result of any such sales or exchanges;

"(3) such additional sums as may be appropriated for the maintenance, operation, exploration, development, and production of the naval petroleum reserves;

"(4) such royalties as may accrue under the provisions of section 7433; and

"(5) any other revenues resulting from the operation of the naval petroleum reserves.

"(b) Funds available in the naval petroleum reserve special account shall be available for expenditure in such sums as are specified in annual appropriations Acts for the expenses of—

"(1) exploration, prospecting, conservation, development, use, operation, and production of the naval petroleum reserves as authorized by this chapter;

"(2) production (including preparation for production) as authorized by this chapter, or as may hereafter be authorized;

"(3) the construction and operation of facilities both within and outside the naval petroleum reserves incident to the production and the delivery of petroleum, including pipelines and shipping terminals;

"(4) the procurement of petroleum for, and the construction and operation of facilities associated with, the Strategic Petroleum Reserve authorized by sections 151 through 166 of the Energy Policy and Conservation Act; and

"(5) the exploration and study of the National Petroleum Reserve in Alaska as authorized in title I of the Naval Petroleum Reserves Production Act of 1976.

"(c) The budget estimates for annual appropriations from the naval petroleum reserves special account shall be prepared by the Secretary and shall be presented to the Congress by the President independently of the budget of the Department of the Navy and the Department of Defense.

"(d) Contracts under this chapter providing for the obligation of funds may be entered into by the Secretary for a period of five years, renewable, at the option of the Secretary, for an additional five-year period; however, such contracts may obligate funds only to the extent that such funds are made available in annual appropriations."

(14) Section 7433(a) is amended by striking out "of the Navy".

10 USC 7433.

(15) Section 7433(b) is amended by striking out "and oil shale".

10 USC 7434.

(16) Section 7434 is amended by striking out "and oil shale".

10 USC 7435.

(17) Section 7435(b) is amended by striking out "of the Navy".

10 USC 7436.

(18) Section 7436(a) is amended by deleting "of the Navy, subject to approval of the President."

(19) Section 7438 is amended by striking out "Secretary of the Interior" wherever it occurs and inserting therefor "Administrator of the Energy Research and Development Administration"; and by striking out "of the Navy" wherever it occurs.

10 USC 7438.

(20) The table of sections at the beginning of such chapter is amended—

(A) by inserting immediately before

"7421. Jurisdiction and control."

the following:

"7420. Definitions."

(B) by striking out:

"7432. Expenditures; appropriations chargeable."

and inserting in lieu thereof the following:

"7432. Naval petroleum reserve special account."

Approved April 5, 1976.

LEGISLATIVE HISTORY:

HOUSE REPORTS: No. 94-81 Pts. I, 2, 3 (Comm. on Interior and Insular Affairs) and No. 94-156 accompanying H. R. 5919 (Comm. on Armed Services) and No. 94-942 (Comm. of Conference).

SENATE REPORTS: No. 94-327 accompanying S. 2173 (Comm. on Armed Services) and No. 94-708 (Comm. of Conference).

CONGRESSIONAL RECORD:

Vol. 121 (1975): July 8, considered and passed House.

July 28, S. 2173 considered in Senate.

July 29, considered and passed Senate, amended, in lieu of S. 2173.

Vol. 122 (1976): Mar. 24, Senate agreed to conference report.

Mar. 31, House agreed to conference report.

WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS:

Vol. 12, No. 15 (1976): Apr. 5, Presidential statement.

42 USC 6231-6246.

Ante, p. 303.
Budget esti-
mates, pre-
sentation to
Congress.

Contracts.

10 USC 7433.

10 USC 7434.

10 USC 7435.

10 USC 7436.

10 USC 7438.

APPENDIX B - INVESTMENT COSTS

I. ALTERNATIVE A

1. Elk Hills Tank Farm	\$ 8,250,000
2. Pipeline	
a. 43 miles of 26" diameter	10,750,000
b. 84 miles of 28" diameter	24,250,000
c. 30 miles of 32" diameter	12,500,000
3. Pumping Stations	
a. Elk Hills Station	1,700,000
b. 1 intermediate station	2,200,000
4. Cajon Tank Farm (at junction with SOHIO pipeline)	23,000,000
5. Delivery System to SOHIO Pipeline	1,800,000
6. Communications	750,000
7. Supervisory Control	750,000
8. Operations Control Center	150,000
9. Project Inspection	1,500,000
10. Procurement - Materials and Equipment	750,000
11. Right of Way Acquisition	1,400,000
12. Engineering and Design	<u>5,750,000</u>
TOTAL	\$102,000,000

Equivalent Annual Cost (EAC)

i = 10% n = 20 years

Equivalent Annual Cost Factor = .1175

EAC = (Investment Cost) (EAC Factor)

= (\$102,000,000) (.1175) = \$11,985,000

SOURCE: Ref. 9.

II. ALTERNATIVE B

1. Elk Hills Tank Farm	\$ 8,250,000
2. Pipeline	
a. 27 miles of new 26" diameter	8,000,000
b. Acquire 58 miles of existing 20" diameter pipeline	30,000,000*
c. Repair and modify existing 20" diameter pipeline	3,000,000
3. Pumping Stations	
a. Elk Hills Station	1,700,000
b. 2 intermediate stations	3,500,000
4. Port Hueneme Tank Farm	10,300,000
5. Port Hueneme Wharf Facilities	7,500,000
6. Communications	1,300,000
7. Supervisory Control	800,000
8. Operations Control Center	150,000
9. Project Inspection	750,000
10. Procurement - Material and Equipment	600,000
11. Right of Way Acquisitions	300,000
12. Engineering and Design	<u>2,850,000</u>
	TOTAL
	\$81,000,000

Equivalent Annual Cost

i = 10% n = 20 years
 EAC Factor = .1175

EAC = (Investment Cost) (EAC Factor)
 = (\$81,000,000) (.1175)
 = \$9,517,500

SOURCE: Ref. 9

*Based on the asking price provided to the Navy by the present owner.

III. ALTERNATIVE C

1. TOTAL	*	60,000,000
----------	---	------------

Equivalent Annual Cost

i = 10% n = 20 years
EAC Factor = .1175

$$\begin{aligned} \text{EAC} &= (\text{Investment Cost}) (\text{EAC Factor}) \\ &= (60,000,000) (.1175) \\ &= \$7,050,000 \end{aligned}$$

*Detailed engineering cost estimate is not prepared. This estimate is based on a phone conversation on 18 February, 1977, between CDR L. W. Vogel, Office of Naval Petroleum and Oil Reserves, Washington, D.C. and the author.

APPENDIX C - ANNUAL OPERATIONS/MAINTENANCE COSTS

I. ALTERNATIVE A

1. Personnel	\$ 500,000
2. Equipment	70,000
3. Aerial Patrol	40,000
4. Road Maintenance	50,000
5. Energy Costs	<u>1,825,000</u>
TOTAL	\$2,485,000

SOURCE: Ref. 9

II. ALTERNATIVE B

1. Personnel	\$ 775,000
2. Equipment	75,000
3. Aerial Patrol	40,000
4. Road Maintenance	60,000
5. Energy Costs	<u>2,325,000</u>
TOTAL	\$3,275,000

SOURCE: Ref. 9

III. ALTERNATIVE C*

1. Personnel	\$ 604,000
2. Equipment	73,500
3. Aerial Patrol	40,000
4. Road Maintenance	55,000
5. Energy Costs	<u>1,000,000</u>
TOTAL	\$1,772,000

*This estimate is based on a phone conversation on 27 April 1977 between Mr. J. Lagelar, Office of Naval Petroleum and Oil Shale Reserves, Washington, D.C. and the author.

LIST OF REFERENCES

1. American Petroleum Institute, History of Petroleum Engineering, p. 836-837, 1139-1140, 1961.
2. Debanne, J.G., "A Model for Continental Oil Supply and Distribution," Journal of Petroleum Technology, v. 23, p. 1089-1100, September 1971.
3. Department of Defense Instruction 7041.3, October 18, 1972, p. 6.
4. Department of Transportation, Project Independence, Inputs to the Project Independence Evaluation System Integration Model for the Transport of Energy Materials, Volume II, November 1974.
5. "Energy - Will Americans Pay the Price?", U. S. News and World Report, v. LXXXII, No. 17, p. 16, May 2, 1977.
6. Federal Energy Administration, North Slope Crude Where to? - How?, 8 October 1976 (Draft).
7. House of Representatives, 94th Congress, 2nd Session, Report No. 94-942, p. 14, March 23, 1976.
8. Office of Naval Petroleum and Oil Shale Reserves, Annual Report of Operations, p. 14-15, October 1, 1976.
9. Pipeline Technologists Inc., Houston, Texas, Elk Hills Pipeline Preliminary Report Study, February 7, 1977.
10. Platt's Oilgram Price Service, v. 55, No. 33-H, February 16, 1977.
11. Public Law 94-258, 94th Congress, H.R. 49, April 5, 1976.
12. Western Division, Naval Facilities Engineering Command, Environmental Impact Assessments of Alternative Means for Transporting Crude Oil from Naval Petroleum Reserve No. 1, Elk Hills, Tupman, California, to Marketing Terminals, June 19, 1976.
13. Western Division, Naval Facilities Engineering Command, Program Execution Plan, Naval Petroleum Reserve No. 1, Elk Hills, California, May 25, 1976 (Draft).

BIBLIOGRAPHY

1. Cicchetti, Charles J., Alaskan Oil - Alternative Routes and Markets, Johns Hopkins University Press, Baltimore, 1972.
2. Department of Defense, Economic Analysis Handbook, 2nd Edition.
3. Department of Transportation, Project Independence, Analysis of Requirements and Constraints on the Transport of Energy Materials, Volume I, November 1974.
4. Ewing, Robert C., "Pipeline Economics," The Oil and Gas Journal, v. 74, No. 34, p. 77-120, August 23, 1976.
5. House of Representatives, 94th Congress 1st Session, Report No. 94-156, April 18, 1975.
6. National Petroleum Council, Emergency Preparedness For Interruption of Petroleum Imports into the United States, September 1974.
7. National Petroleum Council, Factors Affecting U.S. Petroleum Refining - A Summary, May, 1973.
8. Wilson, Howard, "Can West Coast Absorb New Oil From N. Slope," The Oil and Gas Journal, p. 25-27, October 20, 1975.
9. Wolbert, George S., Jr., American Pipelines, University of Oklahoma Press, Norman, Oklahoma, 1951.

INITIAL DISTRIBUTION LIST

No. Copies

1. Defense Documentation Center
Cameron Station
Alexandria, Virginia 22314 2
2. Library, Code 0142
Naval Postgraduate School
Monterey, California 93940 2
3. Department Chairman, Code 54
Department of Administrative Sciences
Naval Postgraduate School
Monterey, California 93940 1
4. LCDR J. D. Buttinger, Code 54Bk
Department of Administrative Sciences
Naval Postgraduate School
Monterey, California 93940 1
5. Professor J. W. Creighton, Code 54Cf
Department of Administrative Sciences
Naval Postgraduate School
Monterey, California 93940 5
6. Bernard L. Rabold, Jr.
307 University Avenue
Jacksonville, N.C. 28540 2
7. LCDR Barron Benroth, USN
OICC Elk Hills
Western Division, Naval Facilities Engineering Command
SanBruno, California 94066 1
8. Director
Office of Naval Petroleum and Oil Shale Reserves
Washington, D.C. 20360 1
9. Captain Vincent M. Shrinak, USN
Office of Chief of Naval Material
Navy Department
Washington, D.C. 20360 1

10.	RADM N. W. Clements, USN Deputy Commander for Planning Naval Facilities Engineering Command 200 Stovall Street Alexandria, VA 22322	1
11.	RADM Charles C. Heid, USN Commander Atlantic Division, Naval Facilities Engineering Command Norfolk, VA 23511	1
12.	CDR R. P. Cope, USN Assistant Commander for Research & Development Naval Facilities Engineering Command 200 Stovall Street Alexandria, VA 22322	1



1 AUG 78
14 MAY 79
19 MAY 80

25561
26269
26612
26594

Thesis 171598
R127 Rabold.
c.1 A proposed methodology for analyzing the Naval Petroleum Reserve Number One, Elk Hills, California, pipeline construction decision.

1 AUG 78
14 MAY 79
19 MAY 80

25561
26269
26612
26594

Thesis 171598
R127 Rabold.
c.1 A proposed methodology for analyzing the Naval Petroleum Reserve Number One, Elk Hills, California, pipeline construction decision.

thesR127
A proposed methodology for analyzing the



3 2768 002 05236 7
DUDLEY KNOX LIBRARY